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THE ENTEROBACTERIACEAE SUB-COMMITTEE OF THE NOMENCLATURE COMMITTEE OF THE INTERNATIONAL ASSOCIATION OF MICROBIOLOGISTS

Reports of the Enterobacteriaceae Sub-Committee on the groups Salmonella, Shigella, Arizona, Bethesda, Ballerup, Escherichia, Alkalescens-Dispar, Klebsiella, and Proteus in Rio de Janeiro, August, 1950

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ENTEROBACTERIACEAE

Definition and Principles of Classification

A large family of Gram-negative, non-sporing rods, either motile with peritrichous flagella or non-motile. They grow on ordinary media and ferment glucose rapidly with or without gas production. They reduce nitrates to nitrites.

The Enterobacteriaceae are made up of a series of interrelated bacterial types which do not lend themselves to sharp division into tribes or into groups. The transition from group to group is gradual and intermediate strains are found in all cases. Nevertheless, the family is so large and unwieldy that it is desirable to divide it into groups for purposes of practical classification. Within the family are found dense centers composed of biochemically homogenous cultures which also show a high degree of serologic relationship.

These centers of biochemically similar strains compose the groups delineated below. The groups, in turn, are divided into sub-groups based upon the O antigens of the bacteria. The O (somatic) groups are divided into serotypes which are characterized by the K (sheath or capsule) antigens and/or H (flagellar) antigens which they contain. In some groups the types are designated by specific names, in others they are designated only by the antigens which characterize them. From this it should not be assumed that the committee wishes to place emphasis on those types designated by specific epithets. The retention of these names is a matter of convenience and tradition. Such names as Salmonella typhi and Shigella dysenteriae are so well known and so universally used that it seems unwise to abandon them.

It is obvious that cultures which belong to one biochemical group but which possess antigens characteristic of a different biochemical group will be found.

Further, transitional or intermediate strains not readily placed in one or the other of two groups frequently occur. The position of such types each must be considered individually and determined by arbitrary international agreement.

THE SALMONELLA GROUP

Fourth Report of the Enterobacteriaceae Sub-Committee on the Salmonella Group

Salmonella Definition

The Salmonella group consists of serologically related, Gram-negative, aerobic, non-sporing rods, corresponding to Salmonella typhi in staining properties and morphology, showing with certain exceptions, a motile peritrichous phase in which they normally occur. They do not ferment adonitol, lactose, and sucrose, nor liquefy gelatin, nor produce indole, nor hydrolyse urea, nor form acetylmethyl-carbinol. They regularly attack glucose with, but occasionally without, gas production. They do not ferment salicin promptly, but in some cases delayed fermentation occurs.

All members of the group have an antigenic structure by which they can be recognized.

All the known types are pathogenic for man, animals or both.

Because of international agreements serologically related types are considered to belong to the Salmonella group even if their behavior differs from the above properties (fermentation of lactose or sucrose, liquefaction of gelatin, or production of indole). No organism which possesses aberrant cultural and biochemical characteristics is to be included in the Salmonella group unless it contains O and H antigens typical of the Salmonella group.

List of Serotypes of Salmonella recognized by the Sub-Committee since the Third Report of the Salmonella Sub-Committee in 1947

1. Salmonella kisangani Kauffmann and van Oye.
Antigenic structure I, IV, V, XII:a:1, 2.
Typed by Kauffmann and van oye
(Acta Path. 1947, 24:614).

2. Salmonella tinda Kauffmann and Janssens
Antigenic structure I, IV, XXVII, XII:a:e, n, z_{15}
Typed by Kauffmann and Hanssens, 1949
(Acta Path. 1949, 26:719).

3. Salmonella texas Watt, De Capito, Edwards and Moran
Antigenic structure IV, V, SII:k:e, n, z_{15}
Typed by Watt, De Capito, Edwards and Moran
(U.S. Public Health Rpts. 1947, 62:808)

4. Salmonella stanleyville Kauffmann, Courtois and van Oye
Antigenic structure IV, V, XII:z_4, z_{23}:-.
Typed by Kauffmann, Courtois and van Oye.
(Acta Path. 1947, 24:588).

5. Salmonella brancaster Macdonald, Sivell, Emms and Douglas.
Antigenic structure I, IV, XII:z_{29}:-.
Typed by Macdonald, Sivell, Emms and Douglas
(Monthly Bull. Min. Health, London, 1948, 7:158).

6. Salmonella san juan Watt, De Capito, Edwards and Hermann.
Antigenic structure VI, VII:a:1, 5.
Typed by Watt, De Capito, Edwards and Hermann
(U.S. Public Health Rpts. 1950, 65:208).

7. Salmonella edinburg Watt, De Capito, Edwards and Hermann.
Antigenic structure VI, VII:b:1, 5.
Typed by Watt, De Capito, Edwards and Hermann
(U.S. Public Health Rpts. 1950, 65:208).

8. Salmonella leopoldville Kauffmann, van Oye and Evens
Antigenic structure VI, VII:b:z_6
Typed by Kauffmann, van Oye and Evens, 1949
(Acta Path. 1950, 27:32).

9. Salmonella birkenhead Taylor and Douglas
Antigenic structure VI, VII:c:1, 6
Typed by Taylor and Douglas
(J. Clin. Path. 1948, 1:237).

10. Salmonella mission Watt, De Capito, Edwards and Moran
Antigenic structure VI, VII:d:1, 5.
Typed by Watt, De Capito, Edwards and Moran, 1947
(U.S. Public Health Rpts. 1948, 63:223).

11. Salmonella mission var. isangi Kauffmann, Courtois and van Oye.
Antigenic structure VI, VII:d:1, 5.
Typed by Kauffmann, Courtois and van Oye
(Acta Path. 1947, 24:588)

12. Salmonella lomita Edwards, Moran, Watt and De Capito
Antigenic structure VI, VII:e, h:1, 5.
Typed by Edwards, Moran, Watt and De Capito
(U.S. Public Health Rpts. 1950, 65:210).

13. Salmonella norwich
Antigenic structure VI, VII:e, h:1, 6.

14. Salmonella menston Colbeck, Douglas and Taylor
Antigenic structure VI, VII:g, s, t:-.
Typed by Colbeck, Douglas and Taylor

15. Salmonella singapore Sen
Antigenic structure VI, VII:k:e, n, x.
Typed by Sen
(J. Path. and Bact. 1947, 59:505)

16. Salmonella irumu Kauffmann, Courtois and van Oye
Antigenic structure VI, VII:1, v:1, 5.
Typed by Kauffmann, Courtois and van Oye
(Acta Path. 1947, 24:588)

17. Salmonella colorado Edwards and Hermann.
Antigenic structure VI, VII:1, w:1, 5.
Typed by Edwards and Hermann
(J. Bact. 1949, 58:111)

18. Salmonella jerusalem Kauffmann and Silberstein
Antigenic structure VI, VII:1, w:z_{10}
Typed by Kauffmann and Silberstein, 1949
(Acta Path. 1950, 27:78)

19. Salmonella makiso Kauffmann, van Oye and Vandepitte
Antigenic structure VI, VII:1, z_{28}:z_6
Typed by Kauffmann, van Oye and Vandepitte
(Acta Path. 1949, 26:337)

20. Salmonella aequatoria Kauffmann and Reul
Antigenic structure VI, VII:z_4, z_{23}:e, n, z_{15}
Typed by Kauffmann and Reul
(Acta Path. 1949, 26:335)

21. Salmonella mbandaka Kauffmann and Reul
Antigenic structure VI, VII:z_{10}:e, n, z_{15}
Typed by Kauffmann and Reul
(Acta Path. 1949, 26:335)

22. Salmonella takoradi Rewell, Taylor and Douglas
Antigenic structure VI, VIII:i:1, 5.
Typed by Rewell, Taylor and Douglas
(Monthly Bull. Min. Health, London, 1948, 7:266)

23. Salmonella manchester Taylor and Douglas
Antigenic structure VI, VIII:1, v:1, 7.
Typed by Taylor and Douglas
(Monthly Bull. Min. Health, London, 1948, 7:117)

24. Salmonella fayed Anderson, Anderson and Taylor
Antigenic structure VI, VIII:1, w:1, 2
Typed by Anderson, Anderson and Taylor
(J. Path. and Bact. 1947, 59:533)

25. Salmonella hidalgo Watt, De Capito, Edwards and Moran
Antigenic structure VI, VIII:r:e, n, z_{15}
Typed by Watt, De Capito, Edwards and Moran
(U.S. Public Health Rpts. 1948, 63:223)

26. Salmonella tananarive Le Minor, Le Minor and Neel.
Antigenic structure VI, VIII:y:1, 5.
Typed by Le Minor, Le Minor and Neel
(Annal. Inst. Pasteur 1949, 77:199)

27. Salmonella praha Sedlák and Solar
Antigenic structure VI, VIII:y:e, n, z_{15}
Typed by Sedlák and Solar

28. Salmonella sanga Kauffmann, van Oye and Evens
Antigenic structure (VIII):b:1, 7
Typed by Kauffmann, van Oye and Evens, 1949
(Acta Path. 1950, 27:272)

29. Salmonella corvallis Edwards and Hermann
Antigenic structure (VIII), XX:z_4, z_{23}:-.
Typed by Edwards and Hermann
(J. Bact. 1949, 58:111)

30. Salmonella ndolo Kauffmann, van Oye and Evens
Antigenic structure IX, XII:d:1, 5
Typed by Kauffmann, van Oye and Evens, 1949
(Acta Path. 1950, 27:32)

31. Salmonella neasden
Antigenic structure IX, XII:g, s, t:e, n, x

32. Salmonella shoreditch
Antigenic structure IX, XII:r, e, n, z_{15}

33. Salmonella butantan Peluffo, Bier, Amaral and Biocca
Antigenic structure III, X:b:1, 5
Typed by Peluffo, Bier, Amaral and Biocca
(Mem. Inst. Butantan, 1946, 19:211)

34. Salmonella simi Kauffmann and Vandepitte
Antigenic structure III, X:r:e, n, z_{15}
Typed by Kauffmann and Vandepitte, 1949
(Acta Path. 1950, 27:181)

35. Salmonella macallen Edwards, Hermann, Watt and De Capito
Antigenic structure III X:z_{36}:-.
Typed by Edwards, Hermann, Watt and De Capito
(U.S. Public Health Rpts. 1950, 65:212)

36. Salmonella cambridge Wilson, Taylor and Anderson
Antigenic structure III, XV:e, h, :1, w.
Typed by Wilson, Taylor and Anderson
(Monthly Bull. Min. Health, London, 1947, 6:135)

37. Salmonella canoga Bruner and Moran
Antigenic structure (III), (XV):g, s, t:-.
Typed by Bruner and Moran
(J. Bact. 1949, 57:135)

38. Salmonella chittagong Taylor, Hayes, Freeman and Anderson
Antigenic structure (I), III, X, (XIX):b:z_{35}.
Typed by Taylor, Hayes, Freeman and Anderson
(J. Path. and Bact. 1948, 60:35)

39. Salmonella pharr Watt, De Capito, Hermann and Edwards
Antigenic structure XI:b:e, n, z_{15}
Typed by Watt, De Capito, Hermann and Edwards
(U.S. Public Health Rpts. 1950, 65:214)

40. Salmonella chandans Hinshaw and McNeil
Antigenic structure XI :d:e, n, x
Typed by Hinshaw and McNeil
(J. Bact. 1948, 55:870)

41. Salmonella atlanta Saphra and Seligmann
Antigenic structure XIII, XXIII:b:-.
Typed by Saphra and Seligmann
(J. Immunol. 1948, 60:557)

42. Salmonella horsham
Antigenic structure (I), VI, XIV:l, v:e, n, x
Typed by

43. Salmonella caracas
Antigenic structure (I), VI, XIV, XXV:g, m, s:-.
Typed by

44. Salmonella nottingham
Antigenic structure XVI:d:e, n, z_{15} .
Typed by

45. Salmonella shanghai
Antigenic structure XVI:l, v:l, 6
Typed by

46. Salmonella salford
Antigenic structure XVI:l, v:e, n, x
Typed by

47. Salmonella memphis Moran, Edwards and Bruner
Antigenic structure XVIII:k:l, 5
Typed by Moran, Edwards and Bruner
(J. Bact. 1948, 55:285)

48. Salmonella kibusi Kauffmann, van Oye and Vandepitte
Antigenic structure XXVIII:r:e, n, x
Typed by Kauffmann, van Oye and Vandepitte
(Acta Path. 1949, 26:337)

49. Salmonella donna Watt, De Capito, Hermann and Edwards
Antigenic structure XXX:1, v:1, 5
Typed by Watt, De Capito, Hermann and Edwards
(U.S. Public Health Rpts. 1950, 65:214)

50. Salmonella monschaui Carlquist and Coates
Antigenic structure XXXV:m, t:-.
Typed by Carlquist and Coates
(J. Bact. 1947, 53:249)

51. Salmonella riogrande Edwards, Moran, Watt and De Capito
Antigenic structure XL:b:1, 5
Typed by Edwards, Moran, Watt and De Capito
(U.S. Public Health Rpts. 1950, 65:210)

52. Salmonella duval Edwards and West
Antigenic structure I, XL:b:e, n, z_{15}
Typed by Edwards and West
(U.S. Public Health Rpts. 1950, 65:839)

53. Salmonella allandale Edwards and Hermann
Antigenic structure I, XL:k:1, 6
Typed by Edwards and Hermann
(U.S. Public Health Rpts. 1950, 65:547)

54. Salmonella waycross Seligmann and Saphra
Antigenic structure XLI:z_4, z_{23}:-.
Typed by Seligmann and Saphra
(J. Bact. 1948, 55:561)
Synonym: S. Atherton Atkinson, Woodroofe and Macbeth: (in press)

55. Salmonella weslaco Edwards, Hermann, Watt and De Capito. Antigenic structure XLII:z_{36}-.
Typed by Edwards, Hermann, Watt and De Capito
(U.S. Public Health Rpts. 1950, 65:212)

The Kauffmann - White Schema (1949)

Diagnostic Antigenic Schema

Type	O antigen	H antigen Phase 1	H antigen Phase 2
	Group A		
1. S. paratyphi A	I, II, XII	a	-
	Group B		
2. S. kisangani	I, IV, V, XII	a	1, 2
3. S. arechavaleta	IV, V, XII	a	1, 7
4. S. bispebjerg	I, IV, XII	a	e, n, x
5. S. abortus equi	IV, XII	-	e, n, x
6. S. tinda	I, IV, XXVII, XII	a	e, n, z_{15}
7. S. paratyphi B	I, IV, V, XII	b	1, 2
8. S. abony	I, IV, V, XII	b	e, n, x
9. S. abortus bovis	I, IV, XXVII, XII	b	e, n, x
10. S. schleissheim	IV, XXVII, XII	b	-
11. S. abortus ovis	IV, XII	c	1, 6
12. S. altendorf	IV, XII	c	1, 7
13. S. stanley	IV, V, XII	d	1, 2
14. S. schwarzengrund	I, IV, XXVII, XII	d	1, 7
15. S. salinatis	IV, XII	d, e, h	d, e, n, x_{15}
16. S. saint paul	I, IV, V, XII	e, h,	1, 2
17. S. reading	IV, XII	e, h	1, 5
18. S. kaposvar	IV, V, XII	e, (h)	1, 5
19. S. kaapstad	IV, XII	e, h	1, 7
20. S. chester	IV, V, XII	e, h	e, n, x
21. S. san diego	IV, V, XII	e, h	e, n, z_{15}
22. S. derby	I, IV, XII	f, g	-
23. S. essen	IV, XII	g, m	-
24. S. california	IV, XII	g, m, t	-
25. S. budapest	I, IV, XII	g, t	-
26. S. typhi murium	I, IV, V, XII	i	1, 2
27. S. texas	IV, V, XII	k	e, n, z_{15}
28. S. bredeney	I, IV, XXVII, XII	l, v	1, 7
29. S. brandenburg	IV, XII	l, v	e, n, z_{15}
30. S. heidelberg	IV, V, XII	r	1, 2
31. S. coeln	IV, V, XII	y	1, 2
32. S. stanleyville	IV, V, XII	z_4, z_{23}	-
33. S. brancaster	I, IV, XII	z_{29}	-

The Kauffmann - White Schema (1949) continued

Type	O antigen	H antigen Phase 1	Phase 2
	Group C		
34. S. san juan	VI, VII	a	1, 5
35. S. oslo	VI, VII	a	e, n, x
36. S. edinburg	VI, VII	b	1, 5
37. S. leopoldville	VI, VII	b	z_6
38. S. georgia	VI, VII	b	e, n, z_{15}
39. S. paratyphi C	VI, VII, Vi	c	1, 5
40. S. cholerae suis	Vi, VII	c	1, 5
41. S. typhi suis	VI, VII	c	1, 5
42. S. birkenhead	VI, VII	c	1, 6
43. S. mission	VI, VII	d	1, 5
44. S. amersfoort	VI, VII	d	e, n, x
45. S. lomita	VI, VII	e, h	1, 5
46. S. norwich	VI, VII	e, h	1, 6
47. S. braenderup *)	VI, VII	e, h	e, n, z_{15}
48. S. montevideo	VI, VII	g, m, s	-
49. S. menston	VI, VII	g, s, t	-
50. S. thompson	VI, VII	k	1, 5
51. S. daytona	VI, VII	k	1, 6
52. S. singapore	VI, VII	k	e, n, x
53. S. concord	VI, VII	l, v	1, 2
54. S. irumu	VI, VII	l, v	1, 5
55. S. potsdam	VI, VII	l, v	e, n, z_{15}
56. S. colorado	VI, VII	l, w	1, 5
57. S. jerusalem	VI, VII	l, w	z_{10}
58. S. makiso *)	VI, VII	l, z_{28}	z_6
59. S. oranienburg	VI, VII	m, t	-
60. S. virchow	VI, VII	r	1, 2
61, S. infantis	VI, VII	r	1, 5
62. S. papuana	VI, VII	r	e, n, z_{15}
63. S. richmond	VI, VII	y	1, 2
64. S. bareilly	VI, VII	y	1, 5
65. S. hartford	VI, VII	y	e, n, x
66. S. mikawasima	VI, VII	y	e, n, z_{15}

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

The Kauffmann-White Schema (1949) continued

Type	O antigen	H antigen Phase 1	Phase 2
	Group C continued		
67. S. aequatoria	VI, VII	z_4, z_{23}	e, n, z_{15}
68. S. mbandaka	VI, VII	z_{10}	e, n, z_{15}
69. S. tennessee	VI, VII	z29	-
70. S. narashino	VI, VIII	a	e, n, x
71. S. gatuni	VI, VIII	b	e, n, x
72. S. muenchen	VI, VIII	d	1, 2
73. S. manhattan	VI, VIII	d	1, 5
74. S. newport	VI, VIII	e, h	1, 2
75. S. kottbus	VI, VIII	e, h	1, 5
76. S. takoradi	VI, VIII	i	1, 5
77. S. bonariensis	VI, VIII	i	e, n, x
78. S. litchfield	VI, VIII	l, v	1, 2
79. S. manchester	VI, VIII	l, v	1, 7
80. S. fayed	VI, VIII	l, w	1, 2
81. S. bovis morbificans	VI, VIII	r	1, 5
82. S. hidalgo	VI, VIII	r	e, n, z_{15}
83. S. tananarive	VI, VIII	y	1, 5
84. S. praha	VI, VIII	y	e, n, z_{15}
85. S. duesseldorf	VI, VIII	z_4, z_{24}	-
86. S. tallahassee	VI, VIII	z_4, z_{32}	-
87. S. glostrup	VI, VIII	z_{10}	e, n, z_{15}
88. S. sanga	(VIII)	b	1, 7
89. S. virginia	(VIII)	d	-
90 S. kentucky	(VIII), XX	i	z_6
91. S. amherstiana	(VIII)	l, (v)	1, 6
92. S. corvallis	(VIII), XX	z_4, z_{23}	-
	Group D		
93. S. sendai	I, IX, XII	a	1, 5
94. S. miami	I, IX, XII	a	1, 5
95. S. loma-linda	IX, XII	a	e, n, x
96. S. durban	IX, XII	a	e, n, z_{15}
97. S. onarimon	I, IX, XII	b	1, 2
98. S. typhi	IX, XII, Vi	d	-
99. S. ndolo	IX, XII	d	1, 5

The Kauffmann - White Schema (1949) continued

Type	O antigen	H antigen Phase 1	Phase 2
	Group D continued		
100. S.eastbourne	I, IX, XII	e, h	1, 5
101. S.berta	IX, XII	f, g, t	-
102. S.enteritidis	I, IX, XII	g, m	-
103. S.blegdam	IX, XII	g, m, q	-
104. S.pensacola	IX, XII	g, m, t	-
105. S.dublin	I, IX, XII	g, p	-
106. S.rostock	I, IX, XII	g, p.u	-
107. S.moscow	IX, XII	g, q	-
108. S.neasden	IX, XII	g, s, t	e, n, x
109. S.claibornei	I, IX, XII	k	1, 5
110. S.panama	I, IX, XII	l, v	1, 5
111. S.goettingen	IX, XII	l, v	e, n, z_{15}
112. S.dar es salaam	I, IX, XII	l, w	e, n
113. S.napoli	I, IX, XII	l, z_{13}	e, n, x
114. S.javiana	I, IX, XII	l, z_{28}	1, 5
115. S.shoreditch	IX, XII	r	e, n, z_{15}
116. S.canastel	IX, XII	z_{29}	1, 5
117. S.gallinarum	I, IX, XII	-	-
	Group E		
118. S.butantan	III, X	b	1, 5
119. S.shangani	III, X	d	1, 5
120. S.vejle	III, X	e, h	1, 2
121. S.muenster	III, X	e, h	1, 5
122. S.anatum	III, X	e, h	1, 6
123. S.nyborg	III, X	e, h	1, 7
124. S.meleagridis	III, X	e, h	1, w
125. S.zanzibar	III, X	k	1, 5
126. S.london	III, X	l, v	1, 6
127. S.give	III, X	l, v	1, 7
128. S.uganda	III, X	l, z_{13}	1, 5
129. S.weltevreden	III, X	r	z_6
130. S.simi	III, X	r	e, n, z_{15}
131. S.amager	III, X	y	1, 2
132. S.orion	III, X	y	1, 5
133. S.lexington	III, X	z_{10}	1, 5

The Kauffmann - White Schema (1949) continued

Type	O antigen	H antigen Phase 1	Phase 2
Group E continued			
134. S.macallen	III, X	z_{36}	-
135. S.newington *)	III, XV	e, h	1, 6
136. S.selandia	III, XV	e, h	1, 7
137. S.cambridge	III, XV	e, h	1, w
138. S.new brunswick	III, XV	1, v	1, 7
139. S.canoga	(III), (XV)	g, s, t	-
140. S.illinois	(III), (XV)	z_{10}	1, 5
141. S.chittagong	(I), III, X, (XIX)	b	z_{35}
142. S.niloese *)	I, III, XIX	d	z_6
143. S.senftenberg *)	I, III, XIX	g, s, t	-
144. S.taksony *)	I, III, XIX	i	z_6
145. S.simsbury *)	I, III, XIX	-	z_{27}
Group F			
146. S.marseille	XI	a	1, 5
147. S.luciana	XI	a	e, n, z_{15}
148. S.pharr	XI	b	e, n, z_{15}
149. S.chandans	XI	d	e, n, x
150. S.aberdeen	XI	i	1, 2
151. S.veneziana	XI	i	e, n, x
152. S.pretoria	XI	k	1, 2
153. S.senegal	XI	r	1, 5
154. S.rubislaw	XI	r	e, n, x
155. S.solt	XI	y	1, 5
Group G			
156. S.mississippi	I, XIII, XXIII	b	1, 5
157. S.atlanta	XIII, XXIII	b	-
158. S.grumpensis	XIII, XXIII	d	1, 7
159. S.wichita	I, XIII, XXIII	d	-
160. S.havana	I, XIII, XXIII	f, g	-
161. S.borbeck	XIII, XXII	1, v	1, 6
162. S.worthington	I, XIII, XXIII	1, w	z
163. S.poona	XIII, XXII	z	1, 6
164. S.cubana	I, XIII, XXIII	z29	-

The Kauffmann - White Schema (1949) continued

Type	O antigen	H antigen Phase 1	Phase 2
	Group H		
165. S.heves	VI, XIV, XXIV	d	1, 5
166. S.florida	(I), VI, XIV, XXV	d	1, 7
167. S.onderstepoort	(I), VI, XIV, XXV	e, (h)	1, 5
168. S.caracas	(I), VI, XIV, XXV	g, m, s	-
169. S.horsham	(I), VI, XIV, XXV	l, v	e, n, x
170. S.carrau	VI, XIV, XXIV	y	1, 7
171. S.madelia	(I), VI, XIV, XXV	y	1, 7
172. S.sundsvall	(I), VI, XIV, XXV	z	e, n, x
	Group I		
173. S.hvittingfoss	XVI	b	e, n, x
174. S.gaminara	XVI	d	1, 7
175. S.nottingham	XVI	d	e, n, z_{15}
176. S.szentes	XVI	k	1, 2
177. S.orientalis	XVI	k	e, n, z_{15}
178. S.shanghai	XVI	l, v	1, 6
179. S.salford	XVI	l, v	e, n, x
	Further Groups		
180. S.kirkee	XVII	b	1, 2
181. S.memphis	XVIII	k	1, 5
182. S.cerro	XVIII	z_4, z_{23}	-
183. S.minnesota	XXI	b	e, n, x
184. S.kibusi	XXVIII	r	e, n, x
185. S.pomona	XXVIII	y	1, 7
186. S.tel-aviv	XXVIII	y	e, n, z_{15}
187. S.urbana	XXX	b	e, n, x
188. S.donna	XXX	l, v	1, 5
189. S.adelaide	XXXV	f, g	-
190. S.monschaui	XXXV	m, t	-
191. S.inverness	XXXVIII	k	1, 6
192. S.champaign	XXXIX	k	1, 5
193. S.riogrande	XL	b	1, 5
194. S.duval	I, XL	b	e, n, z_{15}
195. S.allandale	I, XL	k	1, 6
196. S.waycross	XLI	z_4, z_{23}	-
197. S.weslaco	XLII	z_{36}	-

The Kauffmann - White Schema (1949) continued

*) It Was shown by Edwards and Moran (Proc. Soc. Exp. Biol. and Med., 1947, 66:230) that S. senftenberg and S. simsbury each could be transformed into the other. Bruner and Edwards (J.Bact., 1948, 55:449) found that in certain instances antigen III, X could be changed to antigen III, XV and again reversed to III, X. Bruner (J.Bact., 1949, 57:387) obtained typical cultures of S. oranienburg from certain strains of S. montevideo. These antigenic changes, all of which were produced by induced variation, are of great interest and undoubtedly throw light on phylogeny and evolution within the genus. Further, it is highly probable that such changes occasionally occur in nature. However, the epidemiological significance of the various Salmonella types is well established and observations such as those cited above in no way detract from the value of antigenic typing in the study of the epidemiology of Salmonella infections. For this reason the types are listed in the schema as they are found in nature.

Report of the International Salmonella Center in Copenhagen

With the financial support of the World Health Organization the International Salmonella Center in Copenhagen was reopened in January, 1949. At the end of 1949 more than 30 Salmonella Centers were functioning and preparations have been made for establishing further centers in different parts of the world.

The following 15 Salmonella diagnostic sera, based on the paper of F. Kauffmann and P. R. Edwards ("A simplification of the serologic diagnosis of Salmonella cultures" in Journal of Laboratory and Clinical Medicine 32:548, 1947) and the necessary test strains were sent to all the centers.

Diagnostic Sera for Slide Agglutination (not absorbed)

No.	Sera	Prepared with
	O Sera	
100	I, II, XII	S. paratyphi A
101	IV, V, XII, XXVII	S. paratyphi B + S. essen 173 + S. schleissheim
102	VI, VII, VIII	S. thompson + S. newport
103	IX, XII	S. typhi + S. enteritidis
104	III, X, XV	S. london + S. newington
105	polyvant	I, II, III, IV, V, VI, VII, VIII, IX, X, XII, XV, XXVII
	Vi-Serum	
106	Vi, ^{1}XXIX, z_{14}	Ballerup living
	H Sera	
107	a	S. paratyphi A
108	b	S. minnesota phase 1
109	c	S. cholerae suis phase 1
110	d	S. typhi
111	e, n, x	S. abortus equi
112	g, p	S. dublin
113	i	S. bonariensis phase 1
114	1, 2, 3, 5	S. newport phase 2 + S. thompson phase 2

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

According to F. Kauffmann and P. R. Edwards (1947), the vast majority of Salmonella strains isolated from man and animals are members of groups A, B, C, D, and E of the Kauffmann-White classification. In 1948, P. R. Edwards, D. W. Bruner and A. B. Moran (J. Inf. Dis. 83:220, 1948) found that 97 per cent of 12000 cultures from man and animals were members of these five O groups. Thus it is evident that the average laboratory needs concern itself only with the identification of Salmonella cultures which are members of five somatic groups. Other cultures occur so rarely that they may be forwarded immediately to a laboratory which specializes in the study of the genus. The routine laboratory should be able to recognize the more important types and any special local types, but should send other cultures for final identification to a Salmonella centre.

The public health laboratory should be able to identify with certainty the following types: S.paratyphi A, S.paratyphi B, S.typhi murium, S.paratyphi C, S.cholerae suis, S.sendai, and S.typhi.

Laboratories engaged in the study of diseases of the domestic animals should be provided with sera that will enable them to identify the following types: S.typhi murium, S. abortus equi, S.abortus ovis, S.cholerae suis, S.dublin, S.gallinarum and S.pullorum.

Recommendations of the Shigella Commission (Enterobacteriaceae Sub-Committee) on the Nomenclature and Classification of the Dysentery Bacilli

Members of the Commission

Chairman: Brigadier J.S.K. Boyd, England
Members: Dr. R. F. Bridges, England
Major P.R. Carlquist, U.S.A.
Dr. W. H. Ewing, U.S.A.
Dr. W. W. Ferguson, U.S.A.

Name of Genus

It is recommended that the name Shigella be adopted as the generic name of the group of intestinal bacteria commonly

known as the dysentery bacilli and that the synonyms Bacillus dysenteriae and Bacterium dysenteriae be discarded.

Definition

The genus Shigella consists of Gram-negative, aerobic, non-motile, non-sporulating rods, corresponding to Shigella dysenteriae (Shiga's bacillus) in staining properties and morphology. All members ferment glucose, some ferment mannitol and, with a few exceptions, all are non-productive of gas from fermentable substances. They do not acidify salicin and adonitol, nor grow on Simmons' citrate agar, nor hydrolyse urea, nor liquefy gelatin, nor form acetyl-methyl-carbinol. Lactose is fermented by Shigella sonnei but only after prolonged incubation. All members of the genus have an antigenic structure by which they can be recognized.

Groups

The genus is divided into four groups:
Group A (mannitol-negative), and
Groups B, C and D (containing most mannitol-positive strains).

Within the groups there occur types characterized by the possession of a distinctive antigen (type-antigen or main-antigen). In certain types having a common main-antigen, significant variations occur in the subsidiary or group antigens. Sub-types have been created to distinguish the more important of such minor divisions in Group B (S. flexneri). In numbering types in a group, Arabic and not Roman numerals are used to avoid the confusion which might arise between the numbers V and X and the letters V and X.

Group A. Shigella dysenteriae (mannitol-negative group).
Type 1 (formerly called S. shigae or S. shiga-krusei). This type, described by Shiga in 1898, is clearly defined and needs no further description.
Type 2 (formerly called S. schmitzii or S. ambigua). This type has stable biochemical characters and a distinctive antigen.

Types 3 to 7

These are types first described by Large and Sankaran, and by Sachs. Five types, as quoted in the classification given at the and of this Report are recognized, each of which has a distinctive type antigen.

Any other mannitol-negative organisms, which may in future be identified as having the characters of the genus, should be added to Group A.

Group B. Shigella flexneri (mannitol-positive group).

This group contains six recognized types, each of which has a distinctive type-antigen or main-antigen and a complex group antigen, components of which are found in other types within the group. Each type has a relatively constant pattern of group antigen but considerable variation in individual components may occur from strain to strain. Certain types have two or more distinct patterns of group antigens which reproduce consistently; these are regarded as sub-types. It is recommended that in classification undue weight should not be given to minor variations in group antigen as these are unimportant, complex, and may even be artificial in nature.

Type 1. S. flexneri Type 1 includes those strains having the type antigen of Andrewes' Flexner V. This antigen occurs in both Andrewes' V and VZ types. Andrewes' conception of the VZ strain as a dual type containing the type antigen of both V and Z has been disproved. It has been shown that this variant is related to Z, not by its type antigen but by its subsidiary or group antigen. It also possesses an antigenic component peculiar to itself, of which the exact nature is still uncertain. Two sub-types are accordingly recognized:

Sub-type 1a, corresponding to Anrewes' V.

Sub-type 1b, corresponding to Andrewes' VZ.

Type 2. S. flexneri Type 2 includes strains having the type antigen of Andrewes' Type W. Two sub-types are recognized.

Sub-type 2a, corresponding to Andrewes' W.
Sub-type 2b, corresponding to Andrewes' WX.

Type 3. S. flexneri Type 3 corresponding to Andrewes' Type Z. So far no sub-types have been described.

Type 4. S. flexneri Type 4 is Boyd's Type 103.

Sub-type 4a corresponds to the strain originally described.

Sub-type 4b differs in possessing group antigen of the type which is present in type 1b (Andrewes' VZ) and in type 3 (Andrewes' Z).

Mannitol negative strains having the specific antigen of type 4 have been described under the name of S. rabaulensis and S. rio. Until further information is available on the nature of the group antigen, it is not proposed to place these in a definite sub-type.

Type 5. S. flexneri Type 5 is Boyd's P 119.

Type 6. S. flexneri Type 6 is Boyd's Type 88 and has so far yielded no antigenic sub-types. Unlike the other Flexner organisms it shows a wide range of biochemical variations (Manchester bacillus, Newcastle bacillus and others), some of which produce gas from fermentable substances.

The antigenic structure of these biochemical variants is identical with that of the type strain and is very stable. For this reason it is recommended that the biochemical inconstancy should be disregarded and that the strains be classified together under one common designation.

S. flexneri variants (X and Y types). The two types described by Andrewes in his classification as X and Y are not valid types, as neither possesses a distinctive

antigen. There is reason to believe that they are variants which have arisen from the degradation of one or other of the type strains. This variation can occur at a very early stage in artificial culture and there is evidence to suggest that such strains may have an independent existence as pathogenic dysentery bacilli. For this reason it is recommended that the name S. flexneri variant (S type) or (Y type) be embodied in the classification to cover any such isolations.

Other mannitol-positive (and exceptionally mannitol-negative) organisms with qualitatively distinct type antigens and with partial or group antigens relating them to the Flexner sub-group which may in future be identified should be added to Group B (S. flexneri).

Group C. Shigella boydii (mannitol-positive group)

This group includes all those organisms which have the biochemical reactions of S. flexneri but do not contain the characteristic group antigen. Each strain possesses its own distinctive type antigen. Six types, which are described by Boyd, have been accepted as members of this sub-group and are shown in the classification at the end of the Report. A seventh type, which was identified during World War 2 in different theatres, and which is now generally called S. etousae, has the necessary qualifications for this sub-group and is accordingly added as Type 7.

Other mannitol-positive organisms which have the characters of the genus and have qualitatively distinct type antigens but no group antigen relating them to the Group B (S. flexneri) should be added to Group C (S. boydii) when identification is confirmed and accepted.

Group D. Shigella sonnei (mannitol-positive, late lactose and saccharose positive).

This organism has synonyms which antedate the specific name of sonnei, such as Duval's bacillus. Kruse's pseudo-dysentery bacillus E and Bacillus ceylonensis A. Nevertheless, its recognition as a dysentery bacillus is mainly due

to the work of Sonne and, as this name has been generally used throughout the literature, it is deemed inadvisable to change it. S. sonnei differs from other dysentery bacilli in being a late fermenter of lactose and saccharose. It has a distinctive antigenic pattern.

Miscellaneous strains

Certain other strains which have from time to time been placed in the Shigella group are excluded for the following reasons:

"Alkalescens" and "Dispar"

These organisms are not included in the Shigella group as outlined above. Investigations which are in progress indicate that they are more closely related to the Escherichia group than to the Shigella group. The biochemical reactions of "Aklalescens" and "Dispar" are similar to those of Escherichia cultures and they contain O and K antigens found in members of the latter group.

Castellani strains

B. ceylonensis A is Shigella sonnei
B. ceylonensis B is "Dispar"
B. columbense) are Escherichia types
B. asiaticum mobile)
B. madampensis belongs to the "Alkalescens-Dispar" group.
S. gintottensis is not available.

Others

These have been described as Shigella spp. but are not accepted as such by the Commission:

S. pfaffii (belongs to Bact. pseudotuberculosis group).
S. equirulis (ferments lactose and decomposes urea).
S. sepsicaemiae (motile and liquefies gelatin).
S. minutissima
S. wakefield
S. tiete (Alkalescens II) belongs to the "Alkalescens-Dispar" group.

Many other strains of a doubtful nature have been reported from time to time in the literature but lack confirmation. As they have not been found in the extensive surveys which have been made in recent years they can be disregarded.

Before any new type of the Shigella genus is accepted by the Nomenclature Committee its characteristics must be conformed by a laboratory recognized by the Enterobacteriaciae Committee.

Recent investigations show that the aerogenic cultures described by Sachs (1943) under the designation A 12 belong to Escherichia coli O group 32. The results of reciprocal absorption tests indicate that the O antigens of cultures A 12 and E.coli O 32 are identical.

Culture 1831, described by Wheeler and stuart (1946), is also a member of an established E.coli O group. The O antigens of cultures 1831 and E.coli O 22 are identical, as demonstrated by reciprocal absorption tests.

In the light of present knowledge of both the biochemical and serological reactions of members of the coli group, types A 12 and 1831 are regarded as aberrant coliform bacteria.

References

A. Sachs, J. Roy, Army Med. Corps. 1943, 80:92.
K. M. Wheeler and C. A. Stuart, J. Bact., 1946, 51:317.
W. H. Ewing and M. C. Hucks. J. Bact., 1950, in press.

Tabular Classification

The recommendations of the Commission are embodied in the following tabulated classification.

Group A	Type	Old designation
		Shigella
Shigella dysenteriae	1	S. shigae, Shiga-kruse bacillus, etc.
"	2	S. schmitzii, S. ambigua
"	3	Q 771)
"	4	Q 1167)
"	5	Q 1030) Large-Sachs
"	6	Q 454) group.
"	7	Q 902)

Group B		Sub-Type	
Shigella flexneri	1	1a	V (Andrewes and Inman)
		1b	VZ " "
" "	2	2a	W " "
		2b	WX " "
" "	3		Z " "
" "	4	4a	103 (Boyd)
		4b	
" "	5		P. 119 (Boyd)
" "	6		88 (Boyd) Manchester-Newcastle bacillus
" "	Variant (X type)		X) (Andrewes and Inman)
	(Y type)		Y)

Group C		
Shigella boydii	1	170 (Boyd)
" "	2	P 288 "
" "	3	D 1 "
" "	4	P 274 "
" "	5	P 143 "
" "	6	D 19 "
" "	7	"Lavington" S. etousae

Tabular classification continued

Shigella

Group D	Old designation
Shigella sonnei	Sonne-Duval bacillus S. ceylonensis A

Establishment of Shigella Centres

The Commission of the Nomenclature and Classification of the genus Shigella are unanimous in considering that authoritative Centres should be established to which all doubtful or anomalous strains having the general characters of the genus could be referred for investigation and to which any apparently new strains could be sent for conformation. It is, therefore, proposed that an International Shigella Centre should be established in the Enteric Bacteriology Laboratory, Communicable Disease Centre, U. S. Public Health Service, Chamblee, Georgia, and that an European and Commonwealth Centre should be established in the Dysentery Reference Laboratory Service, Walton Street, Oxford. It is understood that the first of these proposals is acceptable to the authorities of the United States Public Health Service. Specific sanction has been obtained from the Medical Research Council to nominate the Dysentery Reference Laboratory as the European and Commonwealth Centre.

In addition to the identification of strains, the question of issuing diagnostic sera from these Centres has to be considered. It is not possible for the Dysentery Reference Laboratory, Oxford, to undertake to do this at present and it is suggested that the authorities concerned should be approached to ascertain if the Enteric Bacteriology Laboratory at Chamblee is prepared to do so.

The Enterobacteriaceae Sub-Committee approves the Report of the Shigella Commission on the Nomenclature and Classification of the Shigella group and the proposal to establish an international Shigella Centre in Chamblee, Georgia, and an European and Commonwealth Centre in Oxford, England.

The Arizona Group

Motile rods which produce H_2S but gail to form indol; are methyl red positive and Voges-Proskauer negative; produce acid and gas from glucose; do not utilize d-tartrate when tested by the method of Brown, Duncan and Henry or ferment sucrose, dulcitol, or salicin; ferment lactose with varying avidity and slowly liquefy gelatin. Grow on Simmons' citrate agar.

The organisms produce fatal infections in reptiles, fowls and lower mammals. In man they have been isolated from stools in sporadic cases of gastro-enteritis and from the blood and organs of fatal infections at post mortem. They also are known to produce mass food infection in man. The facts known concerning their zoological distribution indicate that Reptilia, particularly snakes, are the natural hosts of these bacteria.

Many O and H relationships to Salmonella and O relationships to Escherichia are found in the group. Borderline strains occur, the taxonomic position of which must be arbitrarily determined.

The antigenic schema follows:

Group	O antigen	H antigen
	1, 2	1, 2, 5
	1, 2	1, 3, 11
	1, 3	1, 2, 5
	1, 3	1, 3, 11
1	1, 3	1, 2, 10
	1, 3	1, 2, 6
	1, 3	1, 6, 7, 9
	1, 4	1, 2, 5
	1, 4	13, 14
		1, 2, 5
		1, 3, 11
2	5	13, 14
		16, 17, 18
		17, 20

Group	O antigen	H antigen
3	6	1, 2, 5 13, 14
4	7	1, 7, 8 1, 2, 6
5	8	1, 7, 8 13, 14 17, 20
6	9	1, 2, 5 1, 2, 6 1, 7, 8 13, 14 13, 15 16, 17, 18
7	10	1, 2, 5 1, 2, 6 1, 2, 10 1, 3, 11 13, 14 17, 20
8	11	13, 14 16, 17, 18
9	12	1, 6, 7 1, 6, 7, 9
10	13	1, 2, 5 1, 7, 8 1, 3, 11 13, 14 16, 17, 18 17, 20
11	14	1, 2, 5 1, 6, 7, 9
12	15	13, 14 17, 20
13	16	13, 14
14	17	1, 2, 5
15	18	13, 14
16	19	1, 2, 5
17	20	1, 2, 6

Group	O antigen	H antigen
		1,2,5
		1,2,6
18	21	1,2,10
		1,3,11
		17,20
19	22	16,17,18

Reference

Kentucky Agricultural Experiment Station. Bull. 499, 1948.

The Bethesda Group

A group of bacteria of uncertain pathogenicity found frequently in human feces and more rarely in the intestine of lower mammals. These bacteria were studied by Stuart, Wheeler, Rustigian and Zimmerman (1), by Barnes and Cherry (2), and by Edwards, West and Bruner (3). They are motile rods which are methyl red positive; Voges-Proskauer negative; produce H_2S but fail to form indol; utilize d-tratrate: produce gas from glucose and usually ferment dulcitol; do not utilize salicin rapidly; may or may not ferment sucrose; ferment lactose with varying avidity and fail to liquefy gelatin. Grow on Simmons' citrate agar.

The organisms are found both in normal individuals and in cases of gastro-enteritis. Their relationship to diarrheal diseases is not clear. If they produce enteric infections they are of a low order of pathogenicity. The number of strains classified to date is small and the antigens included in the schema are only a few of those known to occur in the group. It should be emphasized that the schema is highly simplified and is a provisional one subject to revision.

Antigenic Schema

H Antigens

O Groups	Phase 1	Phase 2	Type Strains
1	1		Na 1A
	8,9		Ala 20

H antigens continued

O Groups	Phase 1	Phase 2	Type Strains
		3	Na 23
	4		Na 4
2	7		Md 10
	10		Md 8
	11		Ind 6
	2	3	Na 2C
		3	Na 12
3	6	5	Na 11
	7	5	Na 22
	12		Mich 5
		3	Na 19
4	13		Mich 1
	10		Conn 2780
	14		Md 6
5	6, 9		Md 2
	7		Md 1
6	15		Mich 10
	16		Mich 11
7	17		Mich 8

Only O groups, not O antigens, are designated since the O antigens have many relationships and exhibit numerous cross reactions. Absorbed sera are necessary for the determination of several of the O groups.

References

(1) J. Bact., 1943, 45:101.
(2) Amer. J. Pub. Health, 1946, 36:481.
(3) J. Bact., 1948, 55:711.

Supplement to Bethesda Group
The Ballerup Group (Provisional)

A group of cultures having the biochemical properties listed above for the Bethesda group, all of which are related directly or indirectly to the strain originally described as Salmonella ballerup by Kauffmann and Møller. In general, the avidity of the strains for lactose and sucrose is less than that of the Bethesda group. They are found both in man and

animals but occur less frequently than the Bethesda strains. At present they seem to constitute a distinct serologic group but the number of cultures examined to date is not sufficiently numerous to determine whether they should be grouped separately or whether they should be included in the Bethesda group. Their relation to enteric disease has not been established.

Antigenic Schema

Group	O antigen	H antigen	Type Strains
		1 *	Ballerup 107
		2 *	17016
		5, 6 *	8665
		5, 7 *	79
1	1a, 1b, 1c	(5), 8	H 10
		(5), 9	20964
		10 *	16385
		11 *	Dyer
		12	H 8
		3 *	Hormaeche
1	1a, 1b, 1d	5, 7	527
		13	59
		14	14671
		2*	N 153
		2, 3 *	LC 54
1	1a, 1b	15*	17776
		16*	2058
		17	48203
		-	6699
1	1a, 1d, 1e	-	4924
1	(1a), 1f	(2), 3	3153 F
2	2	1 *	3796
3	3	(3), 4	5818
4	4	5, 6	135/49

* Vi antigen known to occur in these types. Other masking antigens having physical properties similar to Vi antigen also occur in the group.

Reference

J. Inf. Dis. 1949, 85:290.

The Escherichia Group

A large group of serologically related Gram-negative and non-sporing rods showing, with certain exceptions, a motile, peritrichous phase in which they normally occur. They commonly form indole and give a negative Voges-Proskauer test, but a positive methyl red reaction. They do not decompose urea and usually they do not grow on Simmons' citrate agar. Gelatin is not liquefied. Lactose is usually fermented.

The subdivision of this group into serotypes is shown in the following diagnostic antigenic schema, according to Kauffmann, Knipschildt and Vahlne. The single serotypes have no special names, but are characterized by their antigenic formula: 1 : 1 : 7 etc.

Diagnostic Escherichia Antigenic Schema
(according to Kauffmann-Knipschildt-Vahlne)

	Antigens		
Group	O	K	H
1	1	1 L	(7)
	1	51	(7)
2	2	1 L	4
	2	1 L	5
	2	1 L	6
	2	1 L	(7)
	2	2a, 2b L	1
	2	5 L	(4)
	2+	5 L	4
	2	7 L	7
	2	51	(7)
3	3	2a, 2b L	2
4	4	3 L	(5)
	4	6 L	5
	4	12 L	(5)
	4	52	(4)
5	5	4 L	4
6	6	2a, 2c L	1
	6	13 L	(1)
	6	15 L	16

Diagnostic Escherichia Antigenic Schema (continued)

Group	Antigens		
	O	K	H
	6 ∓	.	10
6	6	53	.
	6	54	10
	7	1 L	.
7	7	7 L	4
	8	8 L	4
	8	8 L	20
	8	25 B	9
	8	25 B	19
	8	27A	(10)
	8	28 A	19
	8	40	(9)
	8	41	11
	8	42 A	(4)
8	8	43	11
	8	44	.
	8	45	9
	8	46	4
	8	47	2
	8	48 A	9
	8	48 A	19
	8	49	11
	8	49	21
	8	50	(9)
	9	9 L	12
	9	26 A	10
	9	26 A	(19)
	9	28 A	.
	9	29 A	.
	9	30 A	10
	9	30 A	19
9	9	31 A	4
	9	32 A	5
	9	32 A	(10)
	9	33 A	.
	9	34 A	.
	9	35 A	.
	9	36	(19)

Diagnostic Escherichia Antigenic Schema (continued)

Group	Antigens		
	O	K	H
9	9	37 A	.
	9	38 A	.
	9	39 A	9
	9	55 A	.
10	10	5 L	4
11	11	10 L	10
12	12	5 L	.
13	13 +	11 L	11
	13	.	11
14	14	7 L	.
15	15	14 L	4
	15	.	17
	15	.	12
16	16	1 L	.
17	17	16 L	18
	17	.	13
18	18	1 L	7
	18	5 L	(4)
	18+	5 L	7
	18	.	14
19	19a, 19b	.	7
	19a	.	.
20	20	17 L	.
21	21	4 L	19
	21-	11 L	10
	21	14 L	(4)
	21	20 L	(4)
22	22	13 L	1
	22-	24 L	.
23	23	18 L	15
	23	21 L	.
	23	22 L	.
24	24	.	.
25	25	19 L	12
	25	23 L	.

Key to the Diagnostic Escherichia Antigenic Schema

Antigens:

O = thermostable somatic antigens.
K = envelope or capsular antigens.
L and B = thermolabile antigens.
A = thermostable antigens.
H = thermolabile flagellar antigens.

If no letter is suffixed to the K antigens, it indicates K antigens found by Vahlne, the nature of which has not been determined with certainty. However, in his antigenic schema Vahlne attached an A or (A) to K antigens 35, 37, 38, 39, 42, 48, and 55 even though only the agglutinable quality of these forms was examined. These symbols are retained. As to the other uncharacterized antigens recorded by Vahlne, they are probably either L or B antigens.

Identical figures in columns O, K or H mean only identity of the antigens concerned when they are set in the same column. Several differences within the O antigens are not recorded.

+ affixed to a figure means presence of a special factor.

$\overline{+}$ means that the strains contain not the complete antigen but, instead of the lacking part, another antigenic factor.

- means that the complete antigen is not present.

() means that this antigen may also be lacking.

· means that this kind of antigen is lacking.

Reference

F. Kauffmann: J. Immunol. 1947, 57:71.

The Klebsiella Group

A large group of serologically related, Gram-negative, non-sporing, and non-motile rods. Not forming indole, they usually split adonitol and inositol. Often they decompose urea, give a positive Voges-Proskauer test, but a negative methyl red reaction. As a rule they grow on Simmons' citrate agar and ferment lactose. Usually they possess capsules and form mucus.

The subdivision of this group into serotypes is shown in the following diagnostic antigenic schema according to Kauffmann. The single serotypes have no special names, but are characterized by their antigenic formula: 1 : 1 etc.

Diagnostic Klebsiella Antigenic Schema (simplified)

O Group	Capsule Type	Earlier Designation
	1	A
	2	B
	3	C
1	7	.
	8	.
	10	.
	12	.
	2	B
	3	C
2	4	D
	5	E
	6	F
	8	.
3	11	.
	9	.
	13	.
	14	.

Reference

F. Kauffmann: Acta Path. 1949, 26:381.

Alkalescens-Dispar Group

This group may be regarded as a part of the Escherichia group containing types which are non-motile and do not produce gas from fermentable substances. Lactose is not fermented by alkalescens strains, but fermented, often delayed, by dispar strains. Serologically the strains belong to the Escherichia group as many contain the same O and K antigens as typical Escherichia strains.

The pathogenicity of alkalescens-dispar strains is not clear; they are found both in normal individuals and in cases of enteritis and urinary tract infections. If they produce enteric infections they are of a low order of pathogenicity.

The subdivision of this group into serotypes is shown in the following diagnostic antigenic schema, according to E. Frantzen. The single serotypes have - like Escherichia types - no special names, but are characterized by their antigenic formula.

Diagnostic Antigenic Schema of the Alkalescens-Dispar Group

O Group	Antigens O	Antigens K	Strain	Earlier Designation
	1a, 1b	1a, 1b	1601	Shigella alkalescens Type I
1	1a, 1b	1a	5379	Shigella alkalescens Type I
	1a	1a, 1b	38949	Shigella alkalescens Type I
	2	1a	589	Shigella alkalescens Type II
2	2	1a, 1b	Üstün	Shigella flexneri
	2	1a, 1b	A-193	Shigella tieté
	3a	2	2-193	Shigella alkalescens Type III
	3a	2	167	Shigella dispar Type IIa *
3	3a	2	205	Shigella dispar Type IIb *
	3a	2	231	Shigella dispar Type IIc *
	3a, 3b	2	54a	
	4	3	2605	Shigella dispar Type I
4	4	-	171	Shigella dispar Type I
	4	.	C 2	Shigella madampensis
5	5	4	145	
	5	3	5513	

* Or B. ceylonensis B.

Diagnostic Antigenic Schema of the Alkalescens-Dispar Group (continued)

O Group	Antigens O	K	Strain	Earlier Designation
6	6	5	2801	Shigella dispar Type III
7	7	1a	2278	
8	8	·	187	

Key: - = strain without K antigen
· = K antigen not investigated

References

F. Kauffmann. Acta Path. 1949, 26:879.
E. Frantzen. Acta Path. 27:236, 1950 and in press.

Proteus vulgaris and P. mirabilis

A large group of serologically related, Gram-negative and non-sporulating rods, showing, with certain exceptions, a motile peritrichous phase in which they normally occur. All known members rapidly decompose urea and attack glucose with, but occasionally without, gas production. Gelatin is liquefied and H_2S is produced. They do not split mannitol and lactose. Usually the Voges-Proskauer test is negative and the methyl red reaction positive. On the usual agar plate (2 per cent agar) the majority of the strains show the swarming phenomenon.

With regard to the biochemical behaviour 2 different biochemical types can be differentiated:

Proteus	Indol	Maltose	Sucrose
vulgaris	+	+	+
mirabilis	-	-	late + or -

The subdivision of this group (Proteus vulgaris and P. mirabilis) into serotypes is shown in the following diagnostic antigenic schema according to Kauffmann and Perch. The single serotypes have no special names, but are characterized by their antigenic formula; 1 : 1 etc. With regard to Winkle's antigenic formulae the reader is referred to the publications of Perch.

Diagnostic Proteus Antigenic Schema (Simplified)
(Proteus vulgaris and P. mirabilis)

O Group	Test Strain	Antigens O	Antigens H
1	X 19	1	1
2	X 2	2	1
3	XK	3	1
	F 403	3	2
4	U 8	4	1
	F 407	4	8
	F 394	4	16
5	F 196	5	1
	F 267	5	3
6	F 181	6	1
	F 78	6	2
	F 116	6	3
7	F 27	7	1
	U 144	7	3
	F 387	7	4
8	F 30	8	1
9	F 62	9	1
	F 75	9	2
10	F 39	10	1
	F 2	10	2
	F 73	10	3
	P 506	10	4
	F 280	10	5
11	F 47	11	1
	F 67	11	2
	P 81	11	3
	F 322	11	6
12	F 65	12	1
	F 358	12	2
13	F 95	13	1
	F 427	13	2
	F 151	13	3
	F 219	13	4
14	F 120	14	1
	S 127	14	3
15	F 121	15	1
	F 295a	15	7

Diagnostic Proteus Antigenic Schema (Simplified)
(continued)

O Group	Test Strain	Antigens O	Antigens H
16	F 55	16	1
	P 206	16	9
	F 485	16	14
17	F 92	17	1
	F 119	17	10
18	F 136	18	1
19	F 313	19	1
	F 311	19	3
	U 349	19	11
20	F 475	20	1
	F 382	20	2
21	M 205	21	1
22	F 233	22	1
23	F 162	23	1
	F 431	23	2
	F 45	23	3
	F 296	23	12
24	F 288	24	1
	F 103	24	3
	F 90	24	4
	F 330	24	13
25	F 276	25	1
26	F 58	26	2
	F 458	26	3
	P 372	26	6
27	F 25	27	2
	U 501	27	3
28	U 509	28	2
	F 87	28	3
29	F 10	29	13
30	F 384	30	1
	F 29	30	2
	F 152	30	4
	U 96	30	13
	F 49	30	15

Diagnostic Proteus Antigenic Schema (Simplified)
(continued)

O Group	Test Strain	Antigens O	Antigens H
31	F 110	31	1
	F 125	31	2
32	F 139	32	1
	F 388	32	3
	F 53	32	5
33	U 510	33	3
34	F 72	34	6
35	F 335	35	2
36	F 305	36	3
	F 398	36	7
37	F 100b	37	17
38	F 420	38	1
	F 158	38	2
39	F 105b	39	18
40	F 386	40	4
41	F 409	41	1
	P 522	41	2
42	F 163	42	1
43	F 433	43	2
44	F 108	44	11
	F 179	44	19
45	F 171	45	11
46	F 223	46	17
47	F 285	47	1
48	P 368	48	1
49	F 389	49	2

References

Beate Perch: Acta Path. 1948, 25:703
S. Winkle: Zbl. Bakt. Orig. 1944/45, 151:494

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

On Escherichia Strains from Infantile, Epidemic Gastro-Enteritis

The interest in the serology of the Escherichia group has been increased by recent investigations of the Escherichia etiology of infantile, epidemic gastro-enteritis. In Scotland, England, U.S.A., the Netherlands, Sweden, and Denmark several outbreaks of infantile gastro-enteritis occurred from which mainly 2 special, serological Escherichia types were isolated. The types are studied and compared with all the types of the Kauffmann - Knipschildt - Vahlne classification and are described by Kauffmann and Dupont in Acta Path. et Microb. Scand. 1950, 27:552.

The majority of the strains belong to a new Escherichia O group 111 (hundred and eleven) and have a new B antigen, designated as B 4. Until now it has not been possible to isolate B minus forms and to demonstrate the pure B agglutinin by absorption. Those strains which belong to O group 111 were designated by Smith as "α-type". Some are motile,, others non-motile. The motile cultures possess the H antigen 2 of the Escherichia group, others the H antigen 12 and belong to another fermentation type. The strains isolated in Denmark are from one outbreak of infantile gastro-enteritis and have the formula 111 : B 4, but in contrast to foreign strains they do not produce indole.

Strains designated by Smith as "β-type" belong to O group 55 formerly set up by Kauffmann. The only strain of this group (Su 3912/41) was isolated from pus from otitis. This strain contains another B antigen, B 5, which is different from the B 4 antigen but identical with the B antigen of the "β-type". In this case, also, it have not been possible to isolate B minus forms and to demonstrate the B 5 agglutinin in pure state. The strains of this type are motile and contain the H 6 antigen of the Escherichia group = 55 : B 5 : 6. The old stock culture of O group 55 was very sluggishly motile, so that its H antigen has not been determined.

In the following table the most significant biochemical characteristics of these strains are given.

For the serologic diagnosis, sera should be prepared by living bacteria; then the determination of the B antigen can be done by slide agglutination with living agar culture, while the diagnosis of O antigens can be done with a boiled culture (1 hour 100° C.) in tube agglutination.

For reference the reader is referred to the paper of Kauffmann and Dupont.

Escherichia Strains from Infantile, Epidemic Gastro-Enteritis

Strain	Antigens O	K	H	Rhamnose	Maltose	Salicin	Sucrose	Indole	Earlier Designation
1. Stoke W	111	B 4	.	+	+	- +	+	+	α
2. Jonna	111	B 4	.	+	+	- +	+	-	.
3. 416	111	B 4	2	+	+	- +	+	+	α
4. Dundee 6	111	B 4	12	- +	+	+	-	+	α
5. Stoke P	55	B 5	6	+	- +	-	+	+	β

Key: + = promptly positive
- + = delayed positive
- = negative

The fermentation of dulcitol and sorbitol is usually delayed, only No. 4 ferments sorbitol promptly.

No fermentation of adonitol and inositol. Prompt fermenta- of arabinose, xylose, lactose, glucose and mannitol (with gas). No production of H_2S and no liquefaction of gelatin. Growth on Simmons' agar containing glucose and no growth on Simmons' agar containing sodium citrate. KNO_3 is reduced, the Voges-Proskauer reaction is negative and the methyl red reaction is positive. Urea is not decomposed.

The International Salmonella Center is sending the test strains of O group 111 and 55 and the corresponding sera to other laboratories and - if wanted - further test strains of all recognized O groups.

The International Center has started this work because an exact diagnosis of infantile, epidemic gastro-enteritis, which has a high mortality, is an important matter of Public Health. Evaluation of the significance of special E.coli types in infant diarrhea is of outstanding importance. Acting already as an International Escherichia Center, it is, therefore, proposed to recommend to W.H.O. to extend this Center in Copenhagen to an "International Salmonella and Escherichia Center".

The Enterobacteriaceae Committee approves this above proposal to recommend to W.H.O. to extend the "International Salmonella Center" to an "International Salmonella and Escherichia Center".

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THE ENTEROBACTERIACEAE SUBCOMMITTEE OF THE NOMENCLATURE COMMITTEE OF THE INTERNATIONAL ASSOCIATION OF MICROBIOLOGISTS*

Reports on the Groups: Salmonella, Shigella, Arizona, Bethesda, Escherichia, Klebsiella (Aerogenes, Aerobacter), Providence (29911 of Stuart et al.)

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INTRODUCTION

A first report on several groups of Enterobacteriaceae was presented by the Subcommittee to the Nomenclature Committee at the Fifth International Congress of Microbiology at Rio de Janeiro, 1950. A progress report is given in the following.

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* Accepted by the International Committee on Bacteriological Nomenclature, September, 1953, Rome, and recommended for publication.

Since differences of opinion may arise in regard to nomenclature, and since the majority of the members of the Subcommittee prefers the terms "groups" and "types" to "genera" and "species", insofar as possible only common names are used throughout the report.

The definition and the principles of classification given in the first report are reaffirmed. No mention is made in the present report on the Proteus and Alkalescens-Dispar groups since their status largely remains unchanged. The majority of the members of the Subcommittee feels that the Alkalescens-Dispar group actually is a part of the Escherichia group, but for practical purposes the schema of E. Frantzen is retained. The reports on the Shigella, Escherichia, and Klebsiella groups are abbreviated since extended schemata of these groups are not again tabulated. Within these groups it is necessary only to call attention to newly accepted or provisionally accepted types and to mention new developments in their study.

It is evident from this report that many groups or types of enteric bacteria are not included. There still remain areas unexplored or insufficiently charted for definite biochemical and serological classification. Notable in this respect are the motile, Voges-Proskauer positive forms which make up the motile strains of the Aerobacter group and their slow-lactose-fermenting counterparts which have been designated by Borman, Stuart, and Wheeler as Paracolobactrum aerogenoides. Likewise, the classification of the cloacae types and of other forms remains in an unsatisfactory condition. It is hoped that these and other deficiencies eventually will be overcome.

The schema of the Arizona group again is included in order to correct a minor discrepancy in the previous report and to include diphasic cultures and newly recognized types. The Bethesda and Ballerup groups are combined in the present report and an extended schema published since knowledge of these bacteria has expanded greatly since the last report. A definition and schema of the Providence group (29911 of Stuart et al.) is included in the Subcommittee report for the first time. Although this group had been defined biochemically by

Stuart and his coworkers, only recently has information regarding its antigenic classification become available.

The Arizona Group

Definition: Motile rods conforming to the definition of the family.

Biochemical Characters

Glucose - Acid produced and usually gas
Mannitol - Acid produced
Adonitol - Acid not produced
Dulcitol - Acid not produced
Inositol - Acid not produced
Lactose - Acid usually produced
Salicin - Acid not produced
Sucrose - Acid not produced
Indole - Not produced
Gelatin - Liquefied
H_2S - Produced
Ammonium citrate - Usually utilized
Voges-Proskauer reaction - Negative
Methyl red reaction - Positive
Urea - Not decomposed
Nitrates - Reduced

The monophasic forms of the group almost invariably fail to produce acid in Jordan's tartrate agar, while the diphasic forms almost without exception acidify the medium. One culture has been found which promptly fermented sucrose. Lactose is attacked with varying avidity, some cultures ferment the sugar with gas production within 24 hours. The majority produce acid within 10 days but some cultures fail to produce detectable acid even when transferred serially in lactose broth.

Organisms of this group have been isolated repeatedly from cases of disease in reptiles, fowls, and mammals, including man. They are found with some frequency in apparently normal reptiles but with relative infrequency in normal warm-blooded animals. Serologic typing has been correlated with epizoological and epidemiological data. The results, together with post mortem findings, infection experiments in fowls, and observed rises in agglutinin titer of individuals from whom the organisms were isolated, suggest that the bacteria have a causative relationship to the disease conditions in which they were found. In recent years these organisms have been found with increasing frequency in sporadic cases and well defined outbreaks of infection in man. Up to the present time, over 1000 cultures have been subjected to serologic typing. The following antigenic schema includes all presently recognized forms.

Antigenic Schema of Arizona Group

O group	O subgroup	O antigen	H antigen	
1			Phase 1	Phase 2
	1,2	1,2	1,2,5	
		1,2	1,3,11	
	1,3	1,3	1,2,5	
		1,3	1,2,6	
		1,3	1,2,10	
		1,3	1,6,7,9	
		1,3	1,3,11	
	1,4	1,4	1,2,5	
		1,4	1,3,11	
		1,4	13,14	
5		5	1,2,5	
		5	1,2,10	
		5	1,3,11	
		5	13,14	
		5	16,17,18	
		5	17,20	
6		6	1,2,5	
		6	13,14	
7		7	1,2,6	
		7	1,7,8	

O group	O subgroup	O antigen	H antigen	
			Phase 1	Phase 2
8		8	1, 7, 8	
		8	13, 14	
		8	17, 20	
9		9	1, 2, 5	
		9	1, 2, 6	
		9	1, 3, 11	
		9	1, 7, 8	
		9	13, 14	
		9	13, 15	
		9	16, 17, 18	
10		10	1, 2, 5	
		10	1, 2, 6	
		10	1, 2, 10	
		10	1, 3, 11	
		10	13, 14	
		10	17, 20	
11		11	1, 2, 5	
		11	13, 14	
		11	16, 17, 18	
12		12	1, 2, 5	
		12	1, 6, 7	
		12	1, 6, 7, 9	
		12	1, 7, 8	
		12	21	23
13		13	1, 2, 5	
		13	1, 3, 11	
		13	1, 7, 8	
		13	13, 14	
		13	13, 15	
		13	16, 17, 18	
		13	17, 20	
14		14	1, 2, 5	
		14	1, 6, 7	
15		15	1, 2, 6	
		15	1, 3, 11	
		15	13, 14	
		15	27	28
16		16	13, 14	

O group	O subgroup	O antigen	H antigen Phase 1	Phase 2
		16	21	22
17		17	1,2,5	
		17	13,15	
		17	29	25
18		18	13,14	
19		19	1,2,5	
		19	1,2,6	
		19	21	22
20		20	1,2,6	
21		21	1,2,5	
		21	1,2,6	
		21	1,2,10	
		21	1,3,11	
		21	17,20	
22		22	16,17,18	
23		23	23	25
		23	24	25
24		24	24	28
		24	26	25
25		25	27	28
26		26	23	30
		26	29	30
27		27	31	22
28		28	32	28

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BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

The Salmonella Group

Fifth Report on the Salmonella Group

Definition: Motile (or nonmotile) rods conforming to the definition of Enterobacteriaceae.

Biochemical Characters

Glucose - Acid produced and usually gas
Mannitol - Acid produced
Adonitol - Acid not produced
Dulcitol - Acid production variable
Inositol - Acid production variable
Lactose - Acid not produced
Salicin - Acid not produced
Sucrose - Acid not produced
Indole - Not produced
Gelatin - Not liquefied
H_2S - Usually produced
Ammonium citrate - Usually utilized
Voges-Proskauer reaction - Negative
Methyl red reaction - Positive
Urea - Not decomposed
Nitrates - Reduced

Many strains of Salmonella are atypical and may not conform entirely to the definition. Assessment of all characters, including biochemical properties and antigenic relationships, shows such strains to be so closely related to typical members of the Salmonella group that they are accepted as such.

All members of the group have an antigenic structure by which they can be recognized.

Most of the known types are pathogenic for man, animals, or both.

Supplement to the Fourth Report of the Enterobacteriaceae Subcommittee on the Salmonella Group.

Salmonella allandale
(U.S. Public Health Rpts. 1950, 65:547).

Salmonella donna
(U.S. Public Health Rpts. 1950, 65:214).

Salmonella duval
(U.S. Public Health Rpts. 1950, 65:839).

Salmonella edinburg
(U.S. Public Health Rpts. 1950, 65:208).

Salmonella lomita
(U.S. Public Health Rpts. 1950, 65:210).

Salmonella macallen
(U.S. Public Health Rpts. 1950, 65:212).

Salmonella menston
(J. Path. and Bact. 1951, 63:754).

Salmonella neasden Douglas, Taylor and McMath.
Antigenic structure 9,12:g,s,t:e,n,x.
Typed by Douglas, Taylor and McMath (Monthly Bull. Min. Health, London, 1951, 10:250).

Salmonella norwich Taylor, McDonald and Sivell.
Antigenic structure 6,7:e,h:1:6.
Typed by Taylor, Mcdonald and Sivell (Monthly Bull. Min. Health, London, 1951, 10:76).

Salmonella nottingham Ludlam, Taylor and Douglas.
Antigenic structure 16:d:e,n,z_{15}.
Typed by Ludlam, Taylor and Douglas (Monthly Bull. Min. Health, London, 1953, 12:29).

Salmonella pharr
(U.S. Public Health Rpts. 1950, 65:214).

Supplement to the Salmonella Group

Salmonella riogrande
(U.S. Public Health Rpts. 1950, 65:210).

Salmonella salford Douglas, Taylor, Greenwood and Ibbotson.
Antigenic structure 16:l, v:e, n, x.
Typed by Douglas, Taylor, Greenwood and Ibbotson (Monthly Bull. Min. Health, London, 1951, 10:75).

Salmonella salford var. maritza Kauffmann.
The strain was isolated and described by Wesselinow and Nedeltschewa as Salmonella maritza (V.M.D. Sofia, 1950, 5:56). According to Kauffmann the strain is a biochemical and serological variant of S. salford (Enterobacteriaceae, 1951, Copenhagen).

Salmonella sanga
(Acta Path. et Microbiol. Scand. 1950, 27:262).

Salmonella san juan
(U.S. Public Health Rpts. 1950, 65:208).

Salmonella shanghai Fournier.
Antigenic structure 16:1, v:1, 6.
Incompletely typed by Fournier (Rapport sur le Fonctionnement technique de l'Institut Pasteur de Changhai, 1948, 1:45). Definitive formula given by Kauffmann (Enterobacteriaceae, 1951, Copenhagen).

Salmonella simi
(Acta Path. et Microbiol. Scand. 1950, 27:181).

Salmonella weslaco
(U.S. Public Health Rpts. 1950, 65:212).

List of Serotypes of Salmonella recognized by the Subcommittee since the Fourth Report in 1950.

1. Salmonella abaetetuba Edwards and McWhorter.
Antigenic structure 11:k:1, 5.

Typed by Edwards and McWhorter (The Public Health Laboratory 1952, 10:103.

2. Salmonella alachua Lowry, Smith, Galton and Edwards.
Antigenic structure 35:z_4, z_{23}:-.
Typed by Lowry, Smith, Galton and Edwards (J. Bact. In press).

3. Salmonella albany West and Edwards.
Antigenic structure (8), 20:z_4, z_{24}:-.
Typed by West and Edwards (U.S. Public Health Rpts. 1951, 66:1062).

4. Salmonella albuquerque Edwards and McWhorter.
Antigenic structure 6, 14, 24:d:z_6.
Typed by Edwards and McWhorter.

5. Salmonella atherton = identical 3 ith S. waycross.
Antigenic structure 41:z_4, z_{23}:-.
Atkinson, Woodroofe and Macbeth (Austral. J. Exper. Biol. and Med. Science 1950, 28:367).

6. Salmonella austin Edwards and Cherry.
Antigenic structure 6, 7:a:1, 7.
Typed by Edwards and Cherry (The Public Health Laboratory 1952, 10:127).

7. Salmonella ball Atkinson, Woodroofe and Macbeth.
Antigenic structure 1, 4, 12:y:e, n, x.
Typed by Atkinson, Woodroofe and Macbeth (Austral. J. Exper. Biol. and Med. Science 1950, 28:377).

8. Salmonella banalia Kauffmann, Courtois and van den Abbeele.
Antigenic structure 6, 8:b:z_6.
Typed by Kauffmann, Courtois and van den Abbeele (Acta Path. et Microbiol. Scand. 1952, 31:326).

9. Salmonella banana Kauffmann, van Oye and Ballion.
Antigenic structure 4, 5, 12:m, t:-.
Typed by Kauffmann, van Oye and Ballion (Acta Path. et Microbiol. Scand. 1951, 28:43).

10. Salmonella belem Edwards and Fife.
Antigenic structure 6, 8:c:e, n, x.
Typed by Edwards and Fife (The Public Health Laboratory 1952, 10:105.

11. Salmonella berkeley Edwards and McWhorter.
Antigenic structure 43:a:1, 5.
Typed by Edwards and McWhorter.

12. Salmonella binza Kauffmann, Vandepitte and van Goethem. Antigenic structure 3, 15:y:1, 5.
Typed by Kauffmann, Vandepitte and van Goethem (Acta Path. et Microbiol. Scand. 1952, 31:431.

13. Salmonella blukwa Kauffmann, Fain and Schoetter.
Antigenic structure 18:z_4, z_{24}:-.
Typed by Kauffmann, Fain and Schoetter (Acta Path. et Microbiol. Scand. 1952, 31:383).

14. Salmonella bolton Greenwood, Powis, Douglas and Taylor.
Antigenic structure 3, 10:y:e, n, z_{15}.
Typed by Greenwood, Powis, Douglas and Taylor (Monthly Bull. Min. Health, London, 1953, 12:29).

15. Salmonella brazil Edwards and Fife.
Antigenic structure 16:a:1, 5.
Typed by Edwards and Fife (The Public Health Laboratory 1952, 10:105).

16. Salmonella broxbourne = identical with S.wien.
Antigenic structure 4, 12:b:1, w.
Douglas and Taylor (Monthly Bull. Min. Health, London, 1951, 10:198).

17. Salmonella cairina Kauffmann, Fain and Schoetter.
Antigenic structure 3, 10:z_{35}:z_6.
Typed by Kauffmann, Fain and Schoetter (Acta Path. et Microbiol. Scand. 1952, 31:383).

18. Salmonella cairo Kauffmann and Floyd.
Antigenic structure 1, 4, 12, 27:d:1, 2.

Typed by Kauffmann and Floyd (Acta Path. et Microbiol. Scand. 1953, 32:124).

19. Salmonella canoga Bruner and Moran.
Antigenic structure (3), (15), 34:g, s, t:-.
Typed by Bruner and Moran (J. of Bact. 1949, 57:135).

20. Salmonella chicago Shaughnessy, Friewer and Lesko.
Antigenic structure 28:r:1, 5.
Typed by Shaughnessy, Friewer and Lesko (Canad. J. Publ. Health 1952, 43:300).

21. Salmonella clerkenwell Story, Douglas and Taylor.
Antigenic structure 3, 10:1, w:z.
Typed by Story, Douglas and Taylor (Monthly Bull. Min. Health, London, 1952, 11:22).

22. Salmonella coquilhatville Kauffmann and Lucasse.
Antigenic structure 3, 10:z_{10}:1, 7.
Typed by Kauffmann and Lucasse (Acta Path. et Microbiol. Scand. 1953, 32:335).

23. Salmonella delplata Leiguarda, Peso and Kempny.
Antigenic structure 1, 13, 23:z_4, z_{23}:-.
Typed by Leiguarda, Peso and Kempny (Anales Soc. Cient. Argent. 1949, 148:168).

24. Salmonella denver Edwards and Cherry.
Antigenic structure 6, 7:a:e, n, z_{15}.
Typed by Edwards and Cherry (The Public Health Laboratory 1952, 10:127).

25. Salmonella elisabethville Kauffmann, Delville, Reul and Bouckaert.
Antigenic structure 3, 10:r:1, 7.
Typed by Kauffmann, Delville, Reul and Bouckaert (Acta Path. et Microbiol. Scand. 1950, 27:492).

26. Salmonella emek Hirsch, Henig and Sapiro.
Antigenic structure (8), 20:g, m, s:-.
Typed by Hirsch, Henig and Sapiro (J. Bact. 1950, 60:213).

27. Salmonella eschweiler Seeliger and Pelz.
Antigenic structure 6, 7:z_{10}:1, 6.
Typed by Seeliger and Pelz (Z. Hyg. und Infekt. 1952, 135: 275).

28. Salmonella haifa Sapiro and Hirsch.
Antigenic structure 1, 4, 5, 12:z_{10}:1, 2.
Typed by Sapiro and Hirsch (J. Bact. 1950, 60:101).

29. Salmonella harrisonburg Edwards and McWhorter.
Antigenic structure (3), (15), 34:z_{10}:1, 6.
Typed by Edwards and McWhorter (Cornell Veterinarian 1953, 43:110).

30. Salmonella homosassa Edwards and Fife.
Antigenic structure (1), 6, 14, 25:z:1, 5.
Typed by Edwards and Fife (U.S. Public Health Rpts. 1951, 66:1060).

31. Salmonella ituri Kauffmann and Fain.
Antigenic structure 1, 4, 12:z_{10}:1, 5.
Typed by Kauffmann and Fain (Acta Path. et Microbiol. Scand. 1953, 32:513).

32. Salmonella johannesburg Kauffmann and Henning.
Antigenic structure 1, 40:b:e, n, x.
Typed by Kauffmann and Henning (Acta Path. et Microbiol. Scand. 1952, 31:586).

33. Salmonella kasenyi Kauffmann and Fain.
Antigenic structure 38:e, h:1, 5.
Typed by Kauffmann and Fain (Acta Path. et Microbiol. Scand. 1953, 32:513).

34. Salmonella kimuenza Kauffmann, Vandepitte and van Goethem.
Antigenic structure 1, 4, 12, 27:1, v:e, n, x.
Typed by Kauffmann, Vandepitte and van Goethem (Acta Path. et Microbiol. Scand. 1952, 31:431).

35. Salmonella kingston Bruner.
Antigenic structure 1, 4, 12, 27:g, s, t:-.
Typed by Bruner (Cornell Veterinarian 1951, 41:339).

36. Salmonella kinshasa Kauffmann and van Oye.
Antigenic structure 3,15:1,z_{13}:1,5.
Typed by Kauffmann and van Oye (Acta Path. et Microbiol. Scand. 1950, 27:519).

37. Salmonella krefeld Seeliger.
Antigenic structure 1,3,19:1,w:y.
Typed by Seeliger (Z. Hyg. und Infekt., 1953, 136:379).

38. Salmonella lindi Telling, Taylor and Douglas.
Antigenic structure 38:r:1,5.
Typed by Telling, Taylor and Douglas (Monthly Bull. Min. Health, London, 1951, 10:251).

39. Salmonella matopeni Telling, Taylor and Douglas.
Antigenic structure 30:y:1,2.
Typed by Telling, Taylor and Douglas (Monthly Bull. Min. Health, London, 1951, 10:251).

40. Salmonella mendoza Leiguarda, Peso, de Pelazzolo and Ansiaume.
Antigenic structure 9,12:1,v:1,2.
Typed by Leiguarda, Peso, de Pelazzolo and Ansiaume(U.S. Public Health Rpts. 1951, 66:1478).

41. Salmonella mgulani Telling, Taylor and Douglas.
Antigenic structure 38:i:1,2.
Typed by Telling, Taylor and Douglas (Monthly Bull. Min. Health, London, 1951, 10:251).

42. Salmonella milwaukee Edwards and Fife.
Antigenic structure 43:f,g:-.
Typed by Edwards and Fife (U.S. Public Health Rpts. 1951, 66:1059).

43. Salmonella montreal = identical with S.wien.
Antigenic structure 4,12:b:1,w.
Laidley, Bailey and Bynoe (Canad. J. Publ. Health 1951, 42: 99).

44. Salmonella morehead Edwards and McWhorter.
Antigenic structure 30:i:1,5.

Typed by Edwards and McWhorter (The Public Health Laboratory 1952, 10:103).

45. Salmonella morotai Atkinson, Woodroofe and Macbeth.
Antigenic structure 17:1, v:1, 2.
Typed by Atkinson, Woodroofe and Macbeth (Austral. J. Exper. Biol. and Med. Science 1950, 28:377).

46. Salmonella nachshonim Kauffmann, Silberstein and Gerichter.
Antigenic structure 1, 13, 23:z:1, 5.
Typed by Kauffmann, Silberstein and Gerichter (Acta Path. et Microbiol. Scand. In press).

47. Salmonella nagoya Nakajima, Naito, Nakaya and Fukumi.
Antigenic structure 6, 8:b:1, 5.
Typed by Nakajima, Naito, Nakaya and Fukumi (Jap. J. Med. Biol. Science. In press).

48. Salmonella ness-ziona Kauffmann, Silberstein and Gerichter.
Antigenic structure 6, 7:1, z_{13}:1, 5.
Typed by Kauffmann, Silberstein and Gerichter (Acta Path. et Microbiol. Scand. 1950, 27:829).

49. Salmonella niarembe Kauffmann and Fain.
Antigenic structure 44:a:1, w.
Typed by Kauffmann and Fain (Acta Path. et Microbiol. Scand. 1953, 32:513).

50. Salmonella oxford Jebb, Douglas and Taylor.
Antigenic structure 3, 10:a:1, 7.
Typed by Jebb, Douglas and Taylor (Monthly Bull. Min. Health, London, 1951, 10:200).

51. Salmonella quiniela Stucker, Galton, Edwards and Fife.
Antigenic structure 6, 8:c:e, n, z_{15}.
Typed by Stucker, Galton, Edwards and Fife (U.S. Public Health Rpts. 1951, 66:1058).

52. Salmonella schoeneberg Boecker and Kauffmann.
Antigenic structure 1, 3, 19:z:e, n, z_{15}.
Typed by Boecker and Kauffmann (Zbl. f. Bakter. I. Orig. 1952, 158:531).

53. Salmonella stanleyville Kauffmann, Courtois and van Oye.
Antigenic structure 4, 5, 12:z_4, z_{23}:1, 2.
The original culture of the type is monophasic = 4, 5, 12:z_4, z_{23}:- as described by Kauffmann, Courtois and van Oye (Acta Path. et Microbiol. Scand. 1947, 24:588).
Later Kauffmann and Defrenne (Acta Path. et Microbiol. Scand. 1951, 29:72) described a diphasic culture.

54. Salmonella stockholm Lagergren and Österling.
Antigenic structure 3, 10:y:z_6.
Typed by Lagergren and Österling. (Acta Path. et Microbiol. Scand. 1951, 29:386).

55. Salmonella tel-hashomer Kauffmann, Silberstein and
Antigenic structure 11:z_{10}:e, n, x. (Gerichter
Typed by Kauffmann, Silberstein and Gerichter (Acta Path. et Microbiol. Scand. 1950, 27:888).

56. Salmonella thomasville Edwards, De Capito and Fife.
Antigenic structure (3), (15), 34:y:1, 5.
Typed by Edwards, De Dapito and Fife (U.S. Public Health Rpts. 1951, 66:1061).

57. Salmonella uzaramo Telling, Taylor and Douglas.
Antigenic structure (1), 6, 14, 25:z_4, z_{24}:-.
Typed by Telling, Taylor and Douglas (Monthly Bull. Min. Health, London, 1951, 10:251).

58. Salmonella vancouver Dolman, Ranta, Hudson, Bynoe, Bailey and Laidley.
Antigenic structure 16:c:1, 5.
Typed by Dolman, Ranta, Hudson, Bynoe, Bailey and Laidley (Canad. J. Publ. Health. 1950, 41:23).

59. Salmonella wagenia Kauffmann, Courtois and van den Abbeele.

Antigenic structure 1,4,12,27:b:e,n,z_{15}.
Typed by Kauffmann, Courtois and van den Abbeele (Acta Path. et Microbiol. Scand. 1951, 28:150).

60. Salmonella wangata Kauffmann and Lucasse.
Antigenic structure 9,12:z_4,z_{23}:-.
Typed by Kauffmann and Lucasse (Acta Path. et Microbiol. Scand. 1953, 32:335).

61. Salmonella westhampton Edwards and McWhorter.
Antigenic structure 3,10:g,s,t:-.
Typed by Edwards and McWhorter (Cornell Veterinarian 1953. 43:110).

62. Salmonella wien Roschka.
Antigenic structure 4,12:b:1,w.
Typed by Roschka (Mitteil. d. Österreich. Sanitätsverwaltung 1951, 52:1).
Published first by F. Kauffmann (Enterobacteriaceae, E. Munksgaard, Copenhagen, 1951).

63. Salmonella worcester Kauffmann and Henning.
Antigenic structure 1,13,23:m,t:e,n,x.
Typed by Kauffmann and Henning (Acta Path. et Microbiol. Scand. 1952, 31:586).

64. Salmonella zega Fain, Kauffmann and Schoetter.
Antigenic structure 9,12:d:z_4.
Typed by Fain, Kauffmann and Schoetter (Acta Path. et Microbiol. Scand. 1952, 31:325).

The Kauffmann-White Schema (1952)

Diagnostic Antigenic Schema

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
	Group A		
1. S. paratyphi A	1,2,12	a	-
	Group B		
2. S.kisangani	1,4,5,12	a	1,2
3. S.arechavaleta	4,5,12	a	1,7
4. S.bispebjerg	1,4,12	a	e,n,x
5. S.abortus-equi	4,12	-	e,n,x
6. S.tinda	1,4,12,27	a	e,n,z_{15}
7. S.paratyphi B	1,4,5,12	b	1,2
8.S.abony	1,4,5,12	b	e,n,x
9. S.abortus-bovis	1,4,12,27	b	e,n,x
10. S. wagenia	1,4,12,27	b	e,n,z_{15}
11. S.schleissheim	4,12,27	b	-
12. S.wien	4,12	b	1,w
13. S.abortus-ovis	4,12	c	1,6
14. S.altendorf	4,12	c	1,7
15. S.stanley	4,5,12	d	1,2
16. S.cairo	1,4,12,27	d	1,2
17. S.schwarzengrund	1,4,12,27	d	1,7
18. S.salinatis	4,12	d,e,h	d,e,n,z_{15}
19. S.saint paul	1,4,5,12	e,h	1,2
20. S.reading	4,12	e,h	1,5
21. S.kaposvar	4,5,12	e,(h)	1,5
22. S.kaapstad	4,12	e,h	1,7
23. S.chester	4,5,12	e,h	e,n,x
24. S.sandiego	4,5,12	e,h	e,n,z_{15}
25. S.derby	1,4,12	f,g	-
26. S.essen	4,12	g,m	-
27. S.california	4,12	g,m,t	-
28. S.kingston	1,4,12,27	g,s,t	-

The Kauffmann-White Schema (1952) continued.

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group B continued			
29. S. budapest	1,4,12	g,t	-
30. S. banana	4,5,12	m,t	-
31. S. typhimurium	1,4,5,12	i	1,2
32. S. texas	4,5,12	k	e,n,z_{15}
33. S. bredeney	1,4,12,27	l,v	1,7
34. S. kimuenza	1,4,12,27	l,v	e,n,x
35. S. brandenburg	4,12	l,v	e,n,z_{15}
36. S. heidelberg	4,5,12	r	1,2
37. S. coeln	4,5,12	y	1,2
38. S. ball	1,4,12	y	e,n,x
39. S. stanleyville	4,5,12	z_4, z_{23}	1,2
40. S. haifa	1,4,5,12	z_{10}	1,2
41. S. ituri	1,4,12	z_{10}	1,5
42. S. brancaster	1,4,12	z_{29}	-
Group C			
43. S. san juan	6,7	a	1,5
44. S. austin	6,7	a	1,7
45. S. oslo	6,7	a	e,n,x
46. S. denver	6,7	a	e,n,z_{15}
47. S. edinburg	6,7	b	1,5
48. S. georgia	6,7	b	e,n,z_{15}
49. S. leopoldville	6,7	b	z_6
50. S. paratyphi C	6,7,Vi	c	1,5
51. S. cholerae-suis	6,7	c	1,5
52. S. typhi-suis	6,7	c	1,5
53. S. birkenhead	6,7	c	1,6
54. S. mission	6,7	d	1,5
55. S. amersfoort	6,7	d	e,n,x
56. S. lomita	6,7	e,h	1,5
57. S. norwich	6,7	e,h	1,6

The Kauffmann-White Schema (1952) continued.

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group C continued			
58. S. braenderup	6, 7	e, h	e, n, z_{15}
59. S. montevideo	6, 7	g, s, t	-
60. S. menston	6, 7	g, s, t	-
61. S. oranienburg	6, 7	m, t	-
62. S. thompson	6, 7	k	1, 5
63. S. daytona	6, 7	k	1, 6
64. S. singapore	6, 7	k	e, n, x
65. S. concord	6, 7	l, v	1, 2
66. S. irumu	6, 7	l, v	1, 5
67. S. potsdam	6, 7	l, v	e, n, z_{15}
68. S. colorado	6, 7	l, w	1, 5
69. S. jerusalem	6, 7	l, w	z_{10}
70. S. ness-ziona	6, 7	l, z_{13}	1, 5
71. S. makiso	6, 7	l, z_{28}	z_6
72. S. virchow	6, 7	r	1, 2
73. S. infantis	6, 7	r	1, 5
74. S. papuana	6, 7	r	e, n, z_{15}
75. S. richmond	6, 7	y	1, 2
76. S. bareilly	6, 7	y	1, 5
77. S. hartford	6, 7	y	e, n, x
78. S. mikawasima	6, 7	y	e, n, z_{15}
79. S. aequatoria	6, 7	z_4, z_{23}	e, n, z_{15}
80. S. eschweiler	6, 7	z_{10}	1, 6
81. S. mbandaka	6, 7	z_{10}	e, n, z_{15}
82. S. tennessee	6, 7	z_{29}	-
83. S. narashino	6, 8	a	e, n, x
84. S. nagoya	6, 8	b	1, 5
85. S. gatuni	6, 8	b	e, n, x
86. S. banalia	6, 8	b	z_6
87. S. belem	6, 8	c	e, n, x
88. S. quiniela	6, 8	c	e, n, z_{15}
89. S. muenchen	6, 8	d	1, 2
90. S. manhattan	6, 8	d	1, 5

The Kauffmann-White Schema (1952) continued.

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group C continued			
91. S.newport	6,8	e,h	1,2
92. S.kottbus	6,8	e,h	1,5
93. S.takoradi	6,8	i	1,5
94. S.bonariensis	6,8	i	e,n,x
95. S.litchfield	6,8	l,v	1,2
96. S.manchester	6,8	l,v	1,7
97. S.fayed	6,8	l,w	1,2
98. S.bovis-morbificans	6,8	r	1,5
99. S.hidalgo	6,8	r	e,n,z_{15}
100. S.tananarive	6,8	y	1,5
101. S.praha	6,8	y	e,n,z_{15}
102. S.duesseldorf	6,8	z_4,z_{24}	-
103. S.tallahassee	6,8.	z_4,z_{32}	-
104. S.glostrup	6,8	z_{10}	e,n,z_{15}
105. S.sanga	(8)	b	1,7
106. S.virginia	(8)	d	-
107. S.emek	(8),20	g,m,s	-
108. S.kentucky	(8),20	i	z_6
109. S.amherstiana	(8)	l,(v)	1,6
110. S.corvallis	(8),20	z_4,z_{23}	-
111. S.albany	(8),20	z_4,z_{24}	-
Group D			
112. S.sendai	1,9,12	a	1,5
113. S.miami	1,9,12	a	1,5
114. S.loma-linda	9,12	a	e,n,x
115. S.durban	9,12	a	e,n,z_{15}
116. S.onarimon	1,9,12	b	1,2
117. S.typhi	9,12,Vi	d	-
118. S.ndolo	9,12	d	1,5

The Kauffmann-White Schema (1952) continued.

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group D continued			
119. S.zega	9,12	d	z_6
120. S.eastbourne	1,9,12	e,h	1,5
121. S.berta	9,12	f,g,t	-
122. S.enteritidis	1,9,12	g,m	-
123. S.blegdam	9,12	g,m,q	-
124. S.pensacola	9,12	g,m,t	-
125. S.dublin	1,9,12	g,p	-
126. S.rostock	1,9,12	g,p,u	-
127. S.moscow	9,12	g,q	-
128. S.neasden	9,12	g,s,t	e,n,x
129. S.claibornei	1,9,12	k	1,5
130. S.mendoza	9,12	l,v	1,2
131. S.panama	1,9,12	l,v	1,5
132. S.goettingen	9,12	l,v	e,n,z_{15}
133. S.dar-es-salaam	1,9,12	l,w	e,n
134. S.napoli	1,9,12	l,z_{13}	e,n,x
135. S.javiana	1,9,12	l,z_{28}	1,5
136. S.shoreditch	9,12	r	e,n,z_{15}
137. S.wangata	9,12	z_4,z_{23}	-
138. S.canastel	9,12	z_{29}	1,5
139. S.gallinarum-pullorum	1,9,12	-	-
Group E			
140. S.oxford	3,10	a	1,7
141. S.butantan	3,10	b	1,5
142. S.shangani	3,10	d	1,5
143. S.vejle	3,10	e,h	1,2
144. S.muenster	3,10	e,h	1,5
145. S.anatum	3,10	e,h	1,6
146. S.nyborg	3,10	e,h	1,7
147. S.meleagridis	3,10	e,h	1,w

The Kauffmann-White Schema (1952) continued

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group E continued			
148. S.westhampton	3,10	g,s,t	-
149. S.zanzibar	3,10	k	1,5
150. S.london	3,10	1,v	1,6
151. S.give	3,10	1,v	1,7
152. S.clerkenwell	3,10	1,w	z
153. S.uganda	3,10	1,z_{13}	1,5
154. S.elisabethville	3,10	r	1,7
155. S.simi	3,10	r	e,n,z_{15}
156. S.weltevreden	3,10	r	z_6
157. S.amager	3,10	y	1,2
158. S.orion	3,10	y	1,5
159. S.bolton	3,10	y	e,n,z_{15}
160. S.stockholm	3,10	y	z_6
161. S.lexington	3,10	z_{10}	1,5
162. S.coquilhatville	3,10	z_{10}	1,7
163. S.cairina	3,10	z_{35}	z_6
164. S.macallen	3,10	z_{36}	-
165. S.newington	3,15	e,h	1,6
166. S.selandia	3,15	e,h	1,7
167. S.cambridge	3,15	e,h	1,w
168. S.new brunswick	3,15	1,v	1,7
169. S.kinshasa	3,15	1,z_{13}	1,5
170. S.binza	3,15	y	1,5
171. S.canoga	(3),(15),34	g,s,t	-
172. S.thomasville	(3),(15),34	y	1,5
173. S.illinois	(3),(15),34	z_{10}	1,5
174. S.harrisonburg	(3),(15),34	z_{10}	1,6
175. S.chittagong	(1),3,10,(19)	b	z_{35}
176. S.niloese	1,3,19	d	z_6
177. S.senftenberg	1,3,19	g,s,t	-

The Kauffmann-White Schema (1952) continued.

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group E continued			
178. S.taksony	1,3,19	i	z_6
179. S.krefeld	1,3,19	l,w	y
180. S.schoeneberg	1,3,19	z	e,n,z_{15}
181. S.simsbury	1,3,19	-	z_{27}
Group F			
182. S.marseille	11	a	1,5
183. S.luciana	11	a	e,n,z_{15}
184. S.pharr	11	b	e,n,z_{15}
185. S.chandans	11	d	e,n,x
186. S.aberdeen	11	i	1,2
187. S.veneziana	11	i	e,n,x
188. S.pretoria	11	k	1,2
189. S.abaetetuba	11	k	1,5
190. S.senegal	11	r	1,5
191. S.rubislaw	11	r	e,n,x
192. S.solt	11	y	1,5
193. S.tel-hashomer	11	z_{10}	e,n,x
Group G			
194. S.mississippi	1,13,23	b	1,5
195. S.atlanta	13,23	b	-
196. S.grumpensis	13,23	d	1,7
197. S.wichita	1,13,23	d	-
198. S.havana	1,13,23	f,g	-
199. S.worcester	1,13,23	m,t	e,n,x
200. S.borbeck	13,22	l,v	1,6
201. S.worthington	1,13,23	l,w	z
202. S.nachshonim	1,13,23	z	1,5
203. S.poona	13,22	z	1,6

The Kauffmann-White Schema (1952) continued

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
Group G continued			
204. S.delplata	1, 13, 23	z_4, z_{23}	-
205. S.cubana	1, 13, 23	z_{29}	-
Group H			
206. S.heves	6, 14, 24	d	1, 5
207. S.florida	(1), 6, 14, 25	d	1, 7
208. S.albuquerque	6, 14, 24	d	z_6
209. S.onderstepoort	(1), 6, 14, 25	e, (h)	1, 5
210. S. caracas	(1), 6, 14, 25	g, m, s	-
211. S.horsham	(1), 6, 14, 25	l, v	e, n, x
212. S.carrau	6, 14, 24	y	1, 7
213. S.madelia	(1), 6, 14, 25	y	1, 7
214, S.homosassa	(1), 6, 14, 25	z	1, 5
215. S.sundsvall	(1), 6, 14, 25	z	e, n, x
216. S.uzaramo	(1), 6, 14, 25	z_4, z_{24}	-
Group I			
217. S.brazil	16	a	1, 5
218. S.hvittingfoss	16	b	e, n, x
219. S.vancouver	16	c	1, 5
220. S.gaminara	16	d	1, 7
221. S.nottingham	16	d	e, n, z_{15}
222. S.szentes	16	k	1, 2
223. S.orientalis	16	k	e, n, z_{15}
224. S.shanghai	16	l, v	1, 6
225. S.salford	16	l, v	e, n, x
Further Groups			
226. S.kirkee	17	b	1, 2

The Kauffmann-White Schema (1952) continued

Type	Somatic Antigens	Flagellar Antigens Phase 1	Phase 2
	Further Groups Continued		
227. S.morotai	17	l, v	1, 2
228. S.memphis	18	k	1, 5
229. S.cerro	18	z_4, z_{23}	-
230. S.blukwa	18	z_4, z_{24}	-
231. S.minnesota	21	b	e, n, x
232. S.chicago	28	r	1, 5
233. S.kibusi	28	r	e, n, x
234. S.pomona	28	y	1, 7
235. S.tel-aviv	28	y	e, n, z_{15}
236. S.urbana	30	b	e, n, x
237. S.morehead	30	i	1, 5
238. S.donna	30	l, v	1, 5
239. S.matopeni	30	y	1, 2
240. S.adelaide	35	f, g	-
241. S.monschaui	35	m, t	-
242. S.alachua	35	z_4, z_{23}	-
243. S.kasenyi	38	e, h	1, 5
244. S.mgulani	38	i	1, 2
245. S.inverness	38	k	1, 6
246. S.lindi	38	r	1, 5
247. S.champaign	39	k	1, 5
248. S.riogrande	40	b	1, 5
249. S.johannesburg	1, 40	b	e, n, x
250. S.duval	1, 40	b	e, n, z_{15}
251. S.allandale	1, 40	k	1.6
252. S.waycross	41	z_4, z_{23}	-
253. S.weslaco	42	z_{36}	-
254. S.berkeley	43	a	1, 5
255. S.milwaukee	43	f, g	-
256. S.niarembe	44	a	l, w

In accordance with the opinion of the majority of the Subcommittee members the symbols used to express the O antigens of Salmonella have been changed from Roman to Arabic numerals.

It is the recommendation of the Subcommittee that from the date of publication of this report all new serological types of Salmonella should be described by formula only and not by name.

Supplement to the Report of the Enterobacteriaceae Subcommittee on the Escherichia coli Group.

Definition: Motile or non-motile rods conforming to the definition of Enterobacteriaceae:

Biochemical Characters

Glucose - Acid produced and usually gas
Mannitol - Acid produced
Adonitol - Acid usually not produced
Dulcitol - Acid production variable
Inositol - Acid usually not produced
Lactose - Acid produced
Salicin - Acid production variable
Sucrose - Acid production variable
Indole - Usually produced
Gelatin - Not liquefied
H_2S - Not produced
Ammonium citrate - Usually not utilized
Voges-Proskauer reaction - Negative
Methyl red reaction - Positive
Urea - Not decomposed
Nitrates - Reduced

Some strains produce acid from lactose late and irregularly, or not at all.

Tests for hydrogen sulfide were made in ferric chloride gelatin according to Kauffmann, Enterobacteriaceae, 1951, Copenhagen.

Supplement to the serological characters

At the close of the year 1952 the Escherichia schema contained 124 different O groups, 60 K antigens, and 33 H antigens. The test strains of O groups 67, 72, 94 and 122 are atypical in that they are indole-negative, H_2S-positive (ferric chloride gelatin), and ammonium citrate-positive.

Due to close relationship of O antigens groups 1 and 31 are joined and group 31 is cancelled. Further O group 47 is cancelled since the test strain of that group is lost.

Escherichia coli from infantile enteritis

O	K	H
111	B 4	2
		12
		2
55	B 5	6
		7
26	B 6	11

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Ørskov, F. Acta Path. et Microbiol. Scand. 1951, 29:373 ; 1952, 31:51, and in press.

The Klebsiella (Klebsiella-Aerogenes) Group

Definition: Nonmotile rods, typically capsulated although noncapsulated variants occur. May or may not produce detectable slime when grown on the usual bacteriological media. Conform to definition of the family.

Biochemical Characters

Glucose - Acid and gas produced
Mannitol - Acid produced
Adonitol - Acid produced
Dulcitol - Acid production variable
Inositol - Acid produced
Lactose - Acid produced
Salicin - Acid produced
Sucrose - Acid produced
Indole - Not produced
Gelatin - Not liquefied
H_2S - Not produced (TSI agar or ferric chloride gelatin)
Ammonium citrate - Utilized
Voges-Proskauer reaction - Positive
Methyl red reaction - Negative
Urea - Decomposed
Nitrates - Reduced

While the above biochemical reactions are considered typical, individual cultures may be found which give aberrant results in any one or several of the tests. Anaerogenic variants are not uncommon. Some strains of capsule type 3 (rhinoscleroma) and of capsule type 4 (ozaena) possess distinctive biochemical reactions. While it is stated that urea is decomposed, it should be understood that urease activity in this group is much less pronounced than is the case in the Proteus group.

At present, 60 capsule types are recognized on the basis of agglutination and capsular (quellung) reactions. Study of the O antigens in this group has not kept pace with development of knowledge of the capsular antigens. This condition is due largely to technical difficulties and to the fact that the somatic antigens of many strains are in the rough state.

Cultures of this group which have been typed were derived largely from respiratory infections and urinary infections in man and from human feces. Capsule types 1 to 6 (A-F), inclusive, usually are found in exudates from the respiratory tract while the remainder of the types occur most often in urinary infections. However, it is not unusual for this situation to be reversed, so that it is impossible to classify the organisms according to source or to the type of disease in which they occur. Further, in the light of our present knowledge, it is not possible to differentiate biochemically between those forms long classified as Klebsiella pneumoniae (Friedlander's bacillus) and the urinary strains often classified as Aerobacter aerogenes (or Bact. aerogenes). For this reason it is necessary, at least for the present, to classify all these forms in the Klebsiella group.

It will be noted that the group, by definition, is composed of non-motile forms. This limitation is unsatisfactory since it provides no category in which biochemically similar motile strains may be placed. Further, some of the motile cultures are capsulated and are agglutinated by, and give positive quellung reactions with sera produced from non-motile cultures. Inasmuch as motility alone is not an infallible character on which to base group differentiation, it would seem logical to include motile forms in the group. However, unpublished data called to the attention of the Subcommittee indicate that it probably is possible to correlate motility with other characteristics and that this combination of characteristics may constitute sufficient reason for considering the motile cultures as a distinct subgroup. Therefore, it is felt that, for the time being, the position of the motile strains should remain sub judice.

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Bethesda (Bethesda-Ballerup) Group

Definition: Motile rods conforming to the definition of the family.

Biochemical Characters

Glucose - Acid produced and usually gas
Mannitol - Acid produced
Adonitol - Acid not produced
Dulcitol - Acid production variable
Inositol - Acid not produced or produced slowly
Lactose - Acid not produced or produced slowly
Salicin - Acid production variable
Sucrose - Acid production variable
Indole - Not produced
Gelatin - Not liquefied
H_2S - Produced
Ammonium citrate - Utilized
Voges-Proskauer reaction - Negative
Methyl red reaction - Positive
Urea - Not decomposed or decomposed slowly
Nitrates - Reduced

Organisms classified in the Bethesda group vary in the speed with which lactose is attacked. Usually lactose is fermented in 3 to 10 days. Some strains fail to ferment the sugar within 30 days. Serologically similar strains may ferment lactose within 24 hours.

Included in the 1950 report of the Subcommittee was a simplified schema of the Bethesda group based on the examination of a small number of cultures. Also included as a provisional group was a number of strains directly or indirectly related to the culture originally described by Kauffmann and Moeller as Salmonella ballerup. The latter cultures were designated as the Ballerup group (provisional). Study of a larger number of cultures during the intervening years revealed that the two groups (Bethesda and Ballerup) possessed similar biochemical characters and that the antigens of the two groups were inextricably intertwined. Thus, it became obvious that the two should be combined in one group and it is recommended that the cultures be designated as the Bethesda group.

The status of the group as incitants of enteric disease remains unchanged from the statement made in the 1950 report. The bacteria appear frequently both in normal persons and in individuals affected with diarrhea. In general, they appear to be commensal forms which inhabit the intestinal tracts of man and of the lower animals. Whether they may at time incite diarrheal disease under favorable conditions of dosage and susceptibility of the exposed individuals remains to be determined. It is hoped that definitive serologic typing will be valuable in determining the distribution of types and that from such data their possible pathogenic role may be assessed. At present the greatest importance of the group is the confusion produced in diagnosis of enteric infections by the superficial similarity of their biochemical reactions to those of the Salmonella group.

Examination of the biochemical characters of the Bethesda group reveals that the organisms are, in reality, the slow-lactose-fermenting counterparts of the indole negative cultures presently classified as Escherichia freundii. A number of cultures of the latter group were examined with serums produced from Bethesda strains. The O and H antigens of many of the cultures could be recognized with the serums used.

The antigenic schema follows:

Antigenic Schema of the Bethesda-Ballerup Group

O group	O antigen	H antigen
1	1a, 1b, 1c	1, 2
	1a, 1b, 1c	14, 15, 16
	1a, 1b, 1c	(21), 25, 26
	1a, 1b, 1c	(25), 21, 27
	1a, 1b, 1c	39
	1a, 1b, 1c	(9) ...
2	2a, 1b	1, 2
	2a, 1b	5, 6
	2a, 1b	7, (8), 10
	2a, 1b	8, 10, 11

Antigenic Schema of the Bethesda-Ballerup Group cont'd.

O group	O antigen	H antigen
2	2a, 1b	14, 15, 16
	2a, 1b	(13), 17
	2a, 1b	21, 22
	2a, 1b	(23), 28
	2a, 1b	32, 34
	2a, 1b	35, 37
	2a, 1b	39
3	3a, 3b, 1c	4, 5
	3a, 3b, 1c	5, 6
	3a, 3b, 1c	7, (8), 10
	3a, 3b, 1c	8
	3a, 3b, 1c	8, 9
	3a, 3b, 1c	(9), 13, 14
	3a, 3b, 1c	14, 15, 16
	3a, 3b, 1c	(13), 17
	3a, 3b, 1c	21, 22
	3a, 3b, 1c	21, 23
	3a, 3b, 1c	21, 24
	3a, 3b, 1c	(21), 25, 27
	3a, 3b, 1c	(9), 29, 30
	3a, 3b, 1c	(9), 29, 31
	3a, 3b, 1c	32, 33
	3a, 3b, 1c	32, 34
	3a, 3b, 1c	39
	3a, 3b, 1c	47
	3a, 3b, 1c	(4), (33)...
	3a, 3b, 1c	-
4	4a, 4b	4, 5
	4a, 4b	5, 6
	4a, 4b	7, (8), 10
	4a, 4b	(9), 13, 14
	4a, 4b	(13), 17
	4a, 4b	(13), 18, 19
	4a, 4b	19, 20
	4a, 4b	(9), 29, 30
	4a, 4b	(9), 29, 31

Antigenic Schema of the Bethesda-Ballerup Group cont'd.

O group	O antigen	H antigen
4	4a, 4b	32, 34
	4a, 4b	44, 45
	4a, 4b	44, 46
	4a, 4b	(31), (45)...
5	5a, 5b, 4b	53, 54
	5a, 5b, 4b	63
	*5a, 5b, 4b	73
	5a, 5b, 4b	-
6	6, 4b, 5b	72
	6, 4b, 5b	(54)...
7	7, 3b, 1c	4, 5
	7, 3b, 1c	7, (8), 10
	7, 3b, 1c	8, 9
	7, 3b, 1c	(9), 13, 14
	7, 3b, 1c	(13), 17
	7, 3b, 1c	21, 22
	7, 3b, 1c	21, 23
	7, 3b, 1c	(21), 25, 27
	7, 3b, 1c	39
	7, 3b, 1c	68
	7, 3b, 1c	(4), (33)...
8	8a, 1c	1, 2
	8a, 1c	5, 6
	8a, 1c	(9), 13, 14
	8a, 1c	(9), 13, 15
	8a, 1c	21, 22
	8a, 1c	(21), 25, 27
	8a, 1c	(9), 29, 30
	8a, 1c	32, 33
	8a, 1c	39
	8a, 1c	53, 55
	8a, 1c	67
	8a, 8b	1, 2

Antigenic Schema of the Bethesda-Ballerup Group cont'd

O group	O antigen	H antigen
8	8a, 8b	8, 12
	8a, 8b	(9), 13, 14
	8a, 8b	(21), 25, 26
	8a, 8b	(21), 25, 27
	8a, 8b	35, 37
8	8a, 8c	5, 6
	8a, 8c	(9), 13, 14
	8a, 8c	(13), 17
	8a, 8c	(21), 25, 27
	8a, 8c	32, 33
	8a, 8c	35, 37
9	9a, 9b	1, 2
	9a, 9b	2, 3
	9a, 9b	4, 5
	9a, 9b	8, 9
	9a, 9b	(13), 17
	9a, 9b	(21), 25, 26
	9a, 9b	32, 33
	9a, 9b	32, 34
	9a, 9b	39
	9a, 9b	48
	9a, 9b	-
10	10, 9b	(13), 17
	10, 9b	(9), 29, 30
	10, 9b	-
11	11	(9), 13, 14
	11	14, 15, 16
	11	32, 33
	11	35, 37
	11	35, (36), 38
	11	77, 78
	11	83
12	12a, 12b	5, 6

Antigenic Schema of the Bethesda-Ballerup Group cont'd

O group	O antigen	H antigen
12	12a, 12b	(13), 17
	12a, 12b	35, 36
	12a, 12b	57
	12a, 12c	57
	12a, 12c	62
13	13	5, 6
	13	59
	13	65
	13	66
	13	69
14	14	40, 41
	14	61
15	15	(13), 18, 19
	15	21, 22
	15	32, 34
16	16	21, 24
	16	58
17	17	21, 24
	17	44, 45
	17	75
18	18	56
19	19	14, 15, 16
	19	87
20	20	40, 41, 43
21	21a, 21b	60
22	22	64
23	23	52

Antigenic Schema of the Bethesda-Ballerup Group cont'd

O group	O antigen	H antigen
24	24	49, 51
25	25	35, (36), 38
26	26	49, 50
	26	59
27	27	40, 41
28	28, 1c	70
29	29	8, 10, 11
	29	40, 42
	29 *	73
	29 *	74
	29 *	74, 75
	29 *	75
	29	77, 78
	29 *	77, 79
	29 *	77
	29	77, 80
	29	77, 81
	29	77, 88
	29 *	82
	29 *	83
	29	84
	29	85
	29 *	86
	29	87
	29	-
30	30, 21b	76
31	31	71
32	32	(23), 28

*Vi antigen is known to occur in these serotypes.

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Edwards, P.R., M.G. West, and D.W. Bruner, 1948. J. Bact. 55:711.
Seeliger, H. Ztschr. f. Hyg. 1952. 134:383.
West, M.G., and P.R. Edwards. In press.

The Providence Group

Definition: Gram negative motile bacteria that conform to the definition of the family.

Biochemical Characters

Glucose - Acid produced and usually gas
Mannitol - Acid usually not produced
Adonitol - Acid production variable
Dulcitol - Acid not produced
Inositol - Acid production variable
Lactose - Acid not produced
Salicin - Acid usually not produced
Sucrose - Acid produced, usually delayed 3 to 8 days
Indole - Produced
Gelatin - Not liquefied
H_2S - Not produced
Ammonium citrate - Utilized
Voges-Proskauer reaction - Negative
Methyl red reaction - Positive
Urea - Not decomposed
Nitrates - Reduced

About 15 per cent of cultures examined are anaerogenic, while the remainder form small gas volumes (a bubble to about 15 per cent) from glucose. An occasional culture ferments mannitol, usually after several days. Adonitol is fermented by more than 90 per cent of the aerogenic cultures but usually is not fermented by the anaerogenic variety. The anaerogenic cultures usually ferment inositol, but the aerogenic cultures do not. An occasional anaerogenic culture

may utilize salicin. An occasional culture may not ferment sucrose. Hydrogen sulfide is not formed on Kligler's, triple sugar iron, or lead acetate agars. An occasional culture may produce a weak delayed reaction in urea agar and a few strains liquefy gelatin after prolonged incubation.

The Providence group is composed of those bacteria that were described as 29911 paracolon bacteria by Stuart et al. (1943, 1946). They occur in stools and in urinary tract infections and often are mistaken for shigellae. Bacteria of the group have been isolated from small outbreaks and from sporadic cases of diarrhea in man, but they also occur in the feces of normal individuals. It is hoped that typing methods will aid in the collection of data which will help determine the pathogenic propensities of members of the group.

The Providence Group Antigenic Schema (Provisional)

O group	O antigen	H antigen
1	1	1
	1	3
	1	11
2	2	2
3	3	2
	3	3
	3	11
	3	18
	3	22
4	4	4
	4	14
5	5	1
	5	4
	5	16
6	6	6
7	7	7

The Providence Group Antigenic Schema (Provisional)
(continued)

O group	O antigen	H antigen
8	8	4
	8	18
9	9	1
	9	8
	9	11
	9	25
10	10	1
	10	9
11	11	10
	11	16
12	12	3
	12	4
	12	15
13	13	5
	13	11
	13	18
14 *	14	4
	14	12
	14	16
15	15	4
	15	(non-motile)
16	16	1
	16	3
	16	4
	16	25
17	17	1
	17	7
	17	11
	17	15

The Providence Group Antigenic Schema (Provisional)
(continued)

O group	O antigen	H antigen
17	17	23
18	18	14
19	19	2
	19	6
20	20	4
21	21	11
	21	23
22	22	1
	22	2
	22	3
	22	4
23	23	3
	23	4
	23	11
	23	18
24	24	4
	24	8
	24	15
25 *	25	4
26	26	1
	26	11
	26	15
	26	28
27	27	17
28	28	9
	28	18

The Providence Group Antigenic Schema (Provisional) (continued).

O group	O antigen	H antigen
29	29	2
	29	8
	29	17
30	30	3
	30	4
	30	18
	30	19
31	31	7
	31	11
	31	18
32	32	11
33	33	1
	33	23
34	34	18
35	35	18
36	36	1
	36	18
	36	19
	36	22
37	37	1
	37	4
	37	8
38	38	1
	38	18
	38	22
39	39	2
	39	18
	39	25

The Providence Group Antigenic Schema (Provisional)
(continued)

O group	O antigen	H antigen
40	40	23
41	41	18
42	42	15
43	43	4
44	44	4
45	45	11
46	46	1
	46	18
	46	24
47	47	4
48	48	25
49	49	1
	49	4
50	50	3
51	51	15
	51	25

* Alpha antigen of Stamp and Stone occurs in O groups 14 and 15.

Cultures of O group 25 contain a K antigen in the form of a capsule.

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The Shigella Group

Second Report of the Shigella Commission of the Enterobacteriaceae Subcommittee

The contents of the Recommendations of the Shigella Commission given in the Report of the Enterobacteriaceae Subcommittee to the 1950 Congress in Rio de Janeiro still are acceptable and are recommended, with the following revisions, emendations, and extensions.

It is recommended that the following revision of the definition of the Shigella group given in the 1950 Report be adopted:

Definition: The Shigella group consists of nonmotile bacteria that conform to the definition of the family.

Biochemical Characters

Glucose - Acid produced without gas production
Mannitol - Acid production variable
Adonitol - Acid not produced
Dulcitol - Acid production variable
Inositol - Acid not produced
Lactose - Acid production variable
Salicin - Acid not produced
Sucrose - Acid production variable
Indole - Produced or not produced
Gelatin - Not liquefied
H_2S - Not produced
Ammonium citrate - Not utilized
Voges-Proskauer reaction - Negative
Methyl red reaction - Positive
Urea - Not decomposed
Nitrates - Reduced

Some cultures of S. flexneri 6 are known to produce small volumes of gas from glucose and other fermentable substances. Mannitol is not fermented by members of subgroup A, but is usually fermented by members of subgroups B and C. Known cultures of subgroup D ferment mannitol. Lactose is not fermented by members of subgroups A, B, or C but is

fermented by members of subgroup D upon prolonged incubation. Hydrogen sulfide is not formed on Kligler's, triple sugar iron, or lead acetate agars.

It is recommended that the term "Groups" as employed in the 1950 Shigella Commission recommendations in reference to the four "groups" within the Shigella group be changed to "Subgroup" as follows:

The Shigella group is divided into four subgroups. Within the subgroups there occur serotypes characterized by the possession of a distinctive antigen, called the type antigen or main antigen. In certain serotypes having a common type or main antigen, significant variation occurs in the subsidiary or group antigens. Sub-serotypes have been designated to distinguish the more important of such minor divisions in subgroup B (S.flexneri). In numbering the serotypes in a subgroup, Arabic numerals are used.

In addition to the recommendations made in the 1950 Report, the adoption of the following characterizations of the composition of the four subgroups is recommended:

Subgroup A, Shigella dysenteriae, is composed of serotypes that do not ferment mannitol and which are serologically unrelated to members of other Shigells subgroups (B, C, D). Each serotype contains a type or main antigen by which it can be identified. New Shigella cultures that (a) do not produce acid from mannitol, (b) that may or may not be related serologically to one or more of the serotypes of subgroup A, and (c) that lack important group antigen relationships to members of subgroups B, C, or D, may be added to subgroup A when the need arises.

Subgroup B, Shigella flexneri, consists of serotypes that usually * produce acid from mannitol and which are interrelated by the possession of common group or minor antigens. However, the serotypes each possess a type or main antigen by which they may be identified. Serotypes that vary

* Mannitol negative variants of S.flexneri 3, 4, and 6 are known to occur.

in their group antigen complexes are known to exist among the serotypes of subgroup B. Thus, two cultures that contain the same type or main antigen may differ in the quality and quantity of the antigens present in their group antigen complexes (e.g., Shigella flexneri 1a and Shigella flexneri 1b). A qualitative loss variation occurs in certain S. flexneri cultures in which the type or main antigen is lost and the resultant variant cultures contain only group factors. New serotypes may be added to subgroup B if they possess group antigens in common with known serotypes and if they possess a new type or main antigen demonstrable by appropriate absorption methods. In classification, undue emphasis should not be given minor variations in the group or minor antigens of S. flexneri cultures.

It is recommended that mannitol negative cultures that contain the type or main antigen of S. flexneri 4, such as those variously referred to as S. rio, S. rabaulensis, and S. saigonensis, be referred to as S. flexneri 4. Such cultures usually can be types as either S. flexneri 4a and 4b and the creation of a special subserotype for them is not thought necessary at this time.

Subgroup C, Shigells boydii, is made up of microorganisms that biochemically are similar to the members of subgroup B but which are not related serologically in a significant way to members of subgroup B. The serotypes of subgroup C may be distinguished by the identification of their specific antigens. New serotypes may be added to this subgroup if such serotypes present biochemical reactions similar to those of described subgroup C serotypes and if such serotypes possess a distinctive type or main antigen and are not related significantly to members of subgroup B.

Intra-subgroup relationships are known to exist between certain serotypes of subgroup C but these interrelationships are not as extensive as the relationships extant in subgroup B (S. flexneri).

Subgroup D, Shigella sonnei consists of microorganisms that biochemically are like members of subgroups B, and C but which ferment lactose upon extended incubation. Only one

serotype is included in subgroup D, but new serotypes may be added if they are similar to S. sonnei in biochemical characters. The O antigens of S. sonnei are not related to other described shigellae in any significant way.

Since the 1950 Report was written, a number of new Shigella serotypes have been described and the proposal made that they be considered for addition to the Shigella schema. It is recommended that those serotypes described as provisional Shigella dysenteriae 8 and provisional Shigella boydii 8, 9, 10, and 11 be added to subgroups A and C, respectively, Further, it is recommended that the mannitol negative serotypes described as Shigella serotype 58, Shigella serotype 3573-50, and Shigella serotype 2050-52 be considered for future addition to subgroup A but remain sub judice. Similar consideration is recommended for those mannitol positive serotypes that have been proposed for addition to subgroup C (Shigella serotype 425, Shigella serotype 703, Shigella serotype 2770-51, and Shigella serotype 123).

REFERENCES

Shigella boydii 8	Serotype 112 (Cox and Wallace, 1948). Courtois, G., and J.M. Vandepitte, 1950, Ann. Soc. Belge de Med. Trop., 30:149.
Shigella boydii 9	Serotype 1296/7 (Boyd, 1946). Ewing, W.H., et al., 1951, Public Health Reports, 66:1579-1586.
Shigella boydii 10	Serotype 430 (Ewing, 1944), D15 (Szturm et al., 1950). Ewing, W.H., and M.W. Taylor, 1951. Public Health Reports, 66:1327-1331.
Shigella boydii 11	Serotype 34 (Ewing, 1943). Ewing, W. H., and M.W. Taylor, 1951. Public Health Reports. 66:1327-1331.
Shigella serotype 58	Cox, C.D., and G.I. Wallace, 1948. J. Immunol., 60:465.
Shigella serotypes	Serotypes 3873/50, 425, 123, and 2770/51. Ewing, W.H., and M.C. Hucks. 1952. J. Immunol. 69:575.

Addendum

A difference of opinion has arisen among the members of the Shigella Commission regarding the nomenclature of the subgroup A, the Shigella dysenteriae subgroup. Brigadier Boyd and Colonel Bensted feel that Shiga's bacterium should be given a special epithet (Shigella shigae for preference, but if this is unacceptable, Shigella dysenteriae) to set it apart from the other serotypes in the subgroup. Kauffmann, Carlquist, and Ewing agree with the subgroup A designations recommended in the 1950 Report of the Shigella Commission, as published in the International Bulletin of Nomenclature and Taxonomy, 1:150-157, 1951, and as recommended in the 2nd Shigella Commission Report, above.